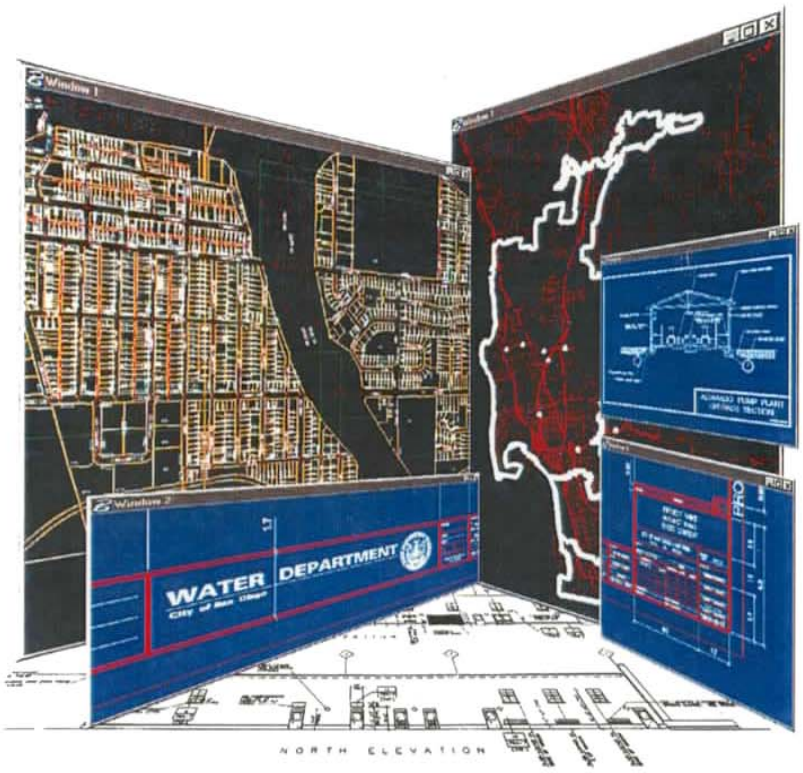
Book

5

Guidelines and Standards

CADD Standards



City of San Diego Water Department
Capital Improvements Program

Issue No.

Water CIP Guidelines and Standards

BOOK 5

CADD STANDARDS

Revision Table

Chapter	Initial Issue	Revised Dates				
1	March 1999					
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PREFACE

This Guidelines and Standards Book contains information to assist planners and engineers with the design and construction of water facilities. The City's intent is to ensure uniformity of design concepts, formats, methodologies, procedures, construction materials, types of equipment and quality of work products. These standards have been produced and adopted to encourage exceptional quality while using current technology for all Water Department facilities.

These Guidelines and Standards are not a substitute for good engineering. Sound judgement must be exercised in all applications to create quality and cost efficient facilities.

Water Department management encourages the creation of relationships between project stakeholders that promotes engineering excellence and timely completion of projects. City staff and consultants are encouraged to take the time at the beginning of all projects to identify common goals, common interests, lines of communication, and a commitment to cooperative problem solving.

LARRY GARDNER
Water Department Director

BOOK LISTING

Book 1	General Design Guidelines
Book 2	Facility Design Guidelines
Book 3	Standard and Guide Details
Book 4	Standard and Guide Specifications
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Book 5

CADD Standards

Chapter 1
Introduction

City of San Diego Water Department
Capital Improvements Program

Chapter 1
INTRODUCTION

The primary deliverable for the Water CIP is the mylar hardcopy, which is the legal document. However, most of the drawings produced for the Water CIP will be generated with CADD. The City plans to use the CADD files created during the predesign, design and construction of Water CIP facilities over the lifetime of those facilities. The structure and format of the CADD files, therefore, are of special importance to the City. Directly related to the structure and format of the CADD files are the drafting standards used to present the information portrayed by the drawings. This Book 5 discusses both CADD Standards, Chapter 2, and General Drafting Standards, Chapter 3.

For certain smaller contracts, the DESIGN CONSULTANT may choose to prepare drawings manually. These General Drafting Standards therefore contain information pertaining to hand lettering, line styles and like design criteria.

1.1 Purpose

These standards are provided to assist the DESIGN CONSULTANTS in achieving the following:

- Graphic consistency and uniformity in all contract drawings.
- Consistent and uniform symbology and abbreviations used in all contract documents, minimizing confusion in the interpretation of those documents.
- An acceptable level of quality and clarity in the contract drawings.
- A basis from which the management and utilization of the data, both graphic and nongraphic, produced for the Water CIP may be organized and integrated for future use by the Water Department .
- A foundation from which Water CIP coordination and interfacing may be streamlined and efficient.

1.2 Scope

These CADD Standards and General Drafting Standards cover most drafting situations encountered in the preparation of drawings for most Water CIP projects. Water CIP projects include reservoirs, pumping stations and water piping systems. In situations not addressed by these standards, the DESIGN CONSULTANT is expected to use good professional judgment in developing its own standards so that the contract documents are clear and concise.

These standards are not intended to be a design textbook or a substitute for professional experience.

Book 5

CADD Standards

Chapter 2
CADD Standards

City of San Diego Water Department
Capital Improvements Program

Chapter 2
CADD STANDARDS

2.1 General

Although the City of San Diego uses the Bentley MicroStation as its basic CADD graphics engine, coupled with Intergraph engineering application programs for engineering design and drawing production, DESIGN CONSULTANTS may use a variety of CADD systems. However, to be compatible with the City, all non-MicroStation CADD files must be translated into MicroStation format. The DESIGN CONSULTANT develops standards for any non-MicroStation CADD system that permits conversion to MicroStation file format, so that the resulting MicroStation files conform to the requirements set forth in this chapter.

The terminology of this CADD Standard follows customary usage for MicroStation systems, recognizing that other CADD systems use different terms for similar concepts.

The Water Department intends to use the MicroStation tag data function to collect data electronically for use with the Documentum Drawing Management System. The MicroStation drawing file will also be used to collect data for the City's graphic information system (GIS) system. Therefore, strict adherence is essential to the General Drafting Standards and CADD Standards governing the information presented on the drawings and the setup of the MicroStation files.

The scope of these standards is to provide the following quality characteristics in the CADD files generated as part of the Water CIP:

1. Hierarchical computer directory structure that allows groups of files from various sources to be easily incorporated into the overall directory structure used by the Water Department.

2. Data separation using level, color, line weight and style within each design file to organize different types of information.

3. Engineering discipline separation using reference files to overlay information for interdiscipline coordination.

4. Logical names for device/directory in attaching reference files, cell libraries and font libraries to design files so that they can be transported among systems without modification.

5. Well organized transmittal and acceptance procedures.

6. Uniformity in major aspects of CADD design such as units of measurement, text size and font, border and title block data.

2.2 Responsibilities of Program Team Members

The following responsibilities apply to all Water CIP activities.

2.2.1 CIP CADD Coordinator

For administrative purposes, the Water CIP is composed of three groups: North City, South City, and Treatment Plants. Each group is administered by a Senior Civil Engineer, assisted in CADD matters by a CADD Coordinator. The CADD Coordinator is the primary CADD contact for all projects administered by the respective group (i.e., North City, South City). The CADD Coordinator is responsible for coordinating all CADD and GIS activities within the group. Throughout this document, references to the Water CIP CADD Coordinator refer to the Water CIP CADD Coordinator for the group administering the DESIGN CONSULTANT's contract.

The CIP CADD Coordinator's role is as follows:

- In conjunction with the other CADD Coordinators, coordination of all CADD policy issues relating to the Water CIP.
- Distribution and maintenance of all Water CIP electronic data pertinent to the respective group.
- Oversight, within a group, of each DESIGN CONSULTANT's implementation of and adherence to the Water CIP CADD Standards.
- In conjunction with the CADD Coordinators of the other Water CIP groups, maintenance of the Water CIP CADD Standards.
- Performance of the final quality control checks on CADD files pertaining to the respective group before turnover to the Water Department.
- Ensuring that delivered CADD files are uploaded into the CIP Drawing Document Management System.

2.2.2 Design Consultant CADD Contact

Each DESIGN CONSULTANT for the Water CIP is responsible for compliance with the CADD Standards and the CADD Standards by all subconsultants to the DESIGN CONSULTANT.

Each DESIGN CONSULTANT designates a CADD Contact. The CADD Contact is the primary contact for the appropriate CIP CADD Coordinator. The CADD Contact should be a key person on the project who understands MicroStation file issues and is fully versed in the Water CIP CADD Standards. The role of each DESIGN CONSULTANT's CADD Contact is as follows:

- Implementation of and adherence to Water CIP CADD Standards.

- Quality assurance of Contract Document drawing files for compliance with Water CIP CADD Standards.

- Coordination and communication with the appropriate Water CIP CADD Coordinator.

2.3 Information Control Procedures

The following procedures apply to the acquisition, exchange and submittal of all CADD-related files.

2.3.1 Requesting Electronic Data

Requests for updated information should be directed to the CADD Coordinator of the Water CIP group administering the DESIGN CONSULTANT's contract.

2.3.2 Exchange of Electronic Data/Interim Submittals

The exchange or transmittal of electronic data from DESIGN CONSULTANT to DESIGN CONSULTANT is not permitted. All electronic data distribution must be through the appropriate Water CIP CADD Coordinator.

When required by design considerations, a Water CIP CADD Coordinator contacts a DESIGN CONSULTANT's CADD Contact to request interim submittals of the latest design data for transmittal to other affected projects. Prior to disseminating interim submittals, the Water CIP CADD Coordinator reviews the electronic data for compliance with Water CIP CADD Standards.

2.3.3 Transmitting Electronic Data to Water CIP

All electronic submittals must be addressed to the CIP Project Manager administering the DESIGN CONSULTANT's contract. Transmittal requirements are described in detail in Section 2.13.

2.4 Water CIP Deliverables

For legal purposes, the primary deliverable for engineering drawings is mylar plots with original signatures and seals. However, delivery of the corresponding electronic data for CADD drawings is also required. The required format, media and documentation are specified in Sections 2.13.4 through 2.13.6.

ALL CADD file final deliverables must be as-built to reflect actual constructed conditions. Files determined by a Water CIP CADD Coordinator to be not in compliance with the Water CIP CADD standards are returned to the DESIGN CONSULTANT for correction and re-submission.

In addition to the scheduled CADD submittals, the DESIGN CONSULTANT must also be prepared to submit design files or contract document drawing files in electronic format at the request of the Water CIP Project Manager.

Because of the distinct difference between pipeline work, as characterized by plan and profile drawings, and other facility work, characterized by such drawings as P&IDs, site plans, floor plans, utility and mechanical drawings, etc., and the intended use of the resulting CADD files by the Water Department, the CADD requirements discussed throughout these CADD Standards is categorized as “Pipeline” drawings and “A&E” drawings.

2.4.1 Pipeline Drawings

Pipeline drawings are submitted in MicroStation “dgn” reference file format. The DESIGN CONSULTANT submits the contract document drawing files and the associated reference files, including any aerial survey and XYZ files used. The DESIGN CONSULTANT also provides a consistent logical naming convention used to attach the reference files. The reverse side of the “Design File Log” is used to document the reference file logical naming conventions. See Attachment 2-1. The City must be able to successfully plot the contract document drawings on the City’s system. See Section 2.9 for additional plotting requirements.

2.4.2 A&E Drawings

All A&E drawings (pumping stations, reservoirs and other facility drawings) are self-contained drawing files in MicroStation “dgn’ format. That is, the design file and the contract document drawing file are the same. If reference files have been used during the course of A&E design, they are merged into the drawing files before this submittal.

The DESIGN CONSULTANT must translate all drawing files generated with another CADD system into MicroStation “dgn” format. Special requirements for translated files are described in Section 2.12.2.

2.5 Drawing Size

The standard drawing size for Water CIP Contract Document drawings is D size which is defined as 34 x 22 inches. For the BODR some drawings or figures may also be B size, 11 x 17 inches, or A size 8-1/2x 11 inches.

2.6 Water CIP CADD File Specifications

The following CADD file specifications apply to MicroStation files.

2.6.1 General

In general, the DESIGN CONSULTANT may generate design drawings using any CADD system and any design application software customarily used. The deliverable CADD drawing files, however, must be in MicroStation dgn format and conform to the Water CIP CADD file specifications described below.

To aid the DESIGN CONSULTANT, certain electronic files are made available through the appropriate Water CIP CADD Coordinator. The latest version of the following types of electronic files are available. The figures referred to in Chapter 3 are samples only. The DESIGN CONSULTANT obtains the latest version from the appropriate CADD Coordinator.

- Cover Sheet for CIP drawings (see typical, Figure 3-15)
- Seed Files for Surveying, Civil Site and Pipeline Drawings
- Seed Files for General, Nonscaled Drawings
- Seed Files for A&E Design Drawings
- Template Seed File for Plan and Profile Drawings (see Figure 3-16)
- CIP Typical Drawing Border with Title Block (see Figure 3-2)
- Cell Libraries
- Font Resource File
- Color Table
- Pen Tables
- Customized Line Styles

Attachment 2-2 lists the available files in tabular form, showing file name, description, intended use and the interrelationships between the files.

2.6.2 File Naming Conventions

CADD file names follow the "eight dot three" convention. The file name is a maximum of eight characters long, with a three-character extension. The extension is the standard MicroStation "dgn," or, if an Intergraph application program is used, the application default extension.

A. A&E Drawings

The primary file naming convention for the Water CIP is based on the drawing number. The basic approach is to use the drawing number as the file name so that a drawing file is uniquely identified as a specific drawing. To accomplish this, the file name for A&E drawings such as plans, elevations, details and schematics consists of three parts plus the "dgn" extension (refer to Chapter 3, Section 3.18.7, for additional information about drawing numbering).

Drawing No. . Discipline Designator . Sequence No . dgn

Example: 19905 m 12 . dgn

Drawing Number – each Water CIP project is assigned a five-digit number by the City; 19905 in the example above.

Discipline Designator – a single-character code used to identify a drawing as civil, structural, electrical, etc.; m (mechanical) in the example above. The single-character discipline designators are listed in Table 3.6 of Chapter 3, Drafting Standards.

Sequence Number – a sequential number between 1 and 99; 12 in the example above.

B. Pipeline Drawings

If the DESIGN CONSULTANT does transmission main piping, the name of the contract drawing CADD file follows the A&E file naming convention explained above. Again, the drawing number is the key part of the name.

Example: 29925 c 08 . dgn

The drawing file name in the example consists of the drawing number (29925), the discipline code (C), and the drawing number (08). Leading zeros are used for numbers less than 10.

Design file and reference file names consist of the five-digit drawing number and a two- or three-character file type code.

Drawing No.¸ File Type . **dgn**

Example: 29925 esi . dgn

File Type – two- or three-character file-type code, esi (existing site) in the example.

Suggested file type codes:

pla	Plan
pro	Profile
sur	Survey File
aer	Aerial File
esi	Existing Site
nsi	New Site
eut	Existing Utilities
nut	New Utilities

The DESIGN CONSULTANT may devise other file-type codes to match its routine design process. However, the description of the file must be clearly specified on the second line of the Design File Log sheet (see Attachment 2-1).

2.6.3 Seed Files

Seed files are furnished to the DESIGN CONSULTANTS by the appropriate Water CIP CADD Coordinator. Three categories of seed files are available for the Water CIP.

A. Site Plans/Pipeline Drawings

Site plans for facilities such as storage reservoirs and pumping stations as well as plan and profiles must be developed using the cip832d.dgn seed file provided by a Water CIP CADD Coordinator (see Attachment 2-2). The facility or pipeline must be located on the design plane with real world Lambert Zone 6 coordinates, and must be drawn full size, using actual dimensions. The seed file is set up so that the entirety of the City of San Diego fits on the design plane.

B. A&E Drawings

A&E drawings are developed using the cips1282.dgn seed file. This is a standard A&E 2D seed file with feet and inches and 8000 parts to the inch where dimensioning is in eighths of an inch. A companion 3D file is also provided. See Attachment 2-2.

The following drawings are developed using this seed file.

- Architectural design, including the Project Architect application program
- Mechanical, structural and electrical design
- Section and Detail sheets

C. General Drawings

General drawings and nonscaled drawings such as process and instrumentation drawings and electrical single-line diagrams are developed using the cips1212.dgn seed file. This is a general purpose 2D seed file set up with feet and inches and 1000 parts to the inch (see Attachment 2-2). Drawings of mechanical parts where dimensioning is in thousandths of an inch are developed with this seed file.

2.6.4 CADD File Parameters

The CADD seed file parameters for working units and global origin for the Water CIP pipeline and civil files are summarized in Attachment 2-3.

A. Working Units

The working units for typical applications are listed below.

1. Civil site drawings, aerial surveys, plan and profiles, INROADS 1:10:1000

2. Architectural, mechanical, structural, electrical design 1:12:8000

3. General nonscaled drawings and figures, process and instrumentation 1:12:1000

B. Global Origin

The global origin for A&E and general drawings, including mechanical scaled drawings and schematic diagrams, is the center of the MicroStation design plane. The value for the global origin for these drawings is GO = 214748.36, 214748.36, 214748.36, For a two-dimensional file, the third value is omitted.

For aerial survey files, the City of San Diego Survey Section, Engineering and Capital Projects, established global origin values that make the MicroStation design plane capable of mapping the City of San Diego boundary when using Lambert Zone 6 Coordinate values in NAD83. The Water Department adopted the same global origin values for aerial survey files, civil drawings and any design files used with site locations. For a three-dimensional file the values are:

NAD83: GO = -6165251.6353, -1772251.6353, 214748.3648

For a two-dimensional file, the third value is omitted. The numbers are shown in the displayed format. If the global origin must be set in a file, key in the value above with the opposite algebraic sign.

C. Grid Units

The standard for grid units varies depending on the type of file and its associated working units. For files with WU = 1:10:1000, the grid units are one minor grid per subunit and one major grid per 10 subunits, so that there is one major grid per foot. For files with WU = 1:12:1000 and WU = 1:12:8000, one minor grid per subunit and one major grid per 12 subunits also puts one major grid per foot.

2.6.5 Level Structure

For A&E drawings the DESIGN CONSULTANT is free to use the level structure it normally uses. However, the DESIGN CONSULTANT must complete a Design File Log sheet for each CADD file to document the levels used in that file. The Design File Log sheet is included with all submittals (see Section 2.13.6). A blank Design File Log sheet is provided in Attachment 2-1.

The City of San Diego standard 2D level structure is used for all pipeline drawings. This level structure is shown in Attachment 2-4.

2.6.6 Fonts

MicroStation Font 1 is the basic text font for the Water CIP. It is a vertical (not slanted), proportionally spaced, non-area fill (stick) font that is delivered with every MicroStation system. General drawing annotation is done using this font. Font 26 is used for the Greek letters needed for scientific or mathematical symbols. Font 50 is the vertical, monospaced, non-area fill font used for charts and columnar tabulations. Font 77 is the filled font that appears in the standard border. Font 102 is the symbol font that is delivered with MicroStation. The upper-case “C” of Font 102 is the standard arrowhead for automatic dimensioning and for note leader lines.

The DESIGN CONSULTANT’s font library should include, at a minimum, MicroStation fonts 1, 26, 50, 77 and 102. The use of other fonts is not recommended. If the DESIGN CONSULTANT feels the need to use other fonts for specific purposes, its CADD Contact must submit a written request and justification to the appropriate Water CIP CADD Coordinator. If special fonts are used on the Water CIP, they must be submitted along with the drawing files.

The City font resource file is available for use by the DESIGN CONSULTANT, and may be obtained from a Water CIP CADD Coordinator. It is named SDFONT.RSC.

2.6.7 Text

The minimum text height for D sized drawings (34 x 22 inches) is 0.12 inch. Normally, text width is equal to text height. Spacing between lines is equal to one-half of text height. Plots

used as half-size drawings may have text which is half as large, since further reduction of these sheets is unlikely. Larger text sizes may be used as required.

Examples of specific text applications for pipeline drawings, with text size and weight indicated, are provided in the publication "CADD TEXT AND SYMBOL STANDARDS" published by the Water and Wastewater Facilities Division, Engineering and Capital Projects Department. This publication is available to the DESIGN CONSULTANT from a Water CIP CADD Coordinator.

2.6.8 Line Styles

The basic line styles used for the Water CIP are the standard line styles provided with MicroStation software. Water Department electronic customized line styles are also available from a Water CIP CADD Coordinator. The custom line styles are shown in Attachment 2-5.

2.6.9 Borders

Border files are provided by a Water CIP CADD Coordinator. The standard border files are:

Name	Working Units	Application
cipb101.dgn	1:10:1000	Civil/Surveying/Pipelines
cipb128.dgn	1:12:8000	A&E Drawings
cipb121.dgn	1:12:1000	General Drawings/Nonscaled

Each border is intended to be used with the corresponding seed files, as illustrated by Attachment 2-2.

For most files, the border is a reference file. See Figure 3-2 for an example.

2.6.10 Title Block

Specifications for filling in the title blocks (text height, weight, etc.) for the standard borders are illustrated in Attachment 2-6.

2.6.11 Color Table

The City color table is available upon request from a Water CIP CADD Coordinator. The color table name is sdcolor.tbl. This color table is used with all CADD files so that they look right on the City CADD system.

2.7 Water CIP Drafting Standards

The Water CIP drafting standards have two parts: general drafting standards and standard CADD symbols.

2.7.1 General Drafting Standards

The drafting standards that govern all drafting for the Water CIP are provided in this book in Chapter 3, General Drafting Standards.

2.7.2 Water CIP CADD Drafting Standards

The Water CIP CADD drafting standards are defined as the standard CADD symbols contained in the following three cell libraries:

- cipeuti.cel Existing Utilities (See Attachment 2-7)
- cipputil.cel Proposed Utilities (See Attachment 2-8)
- cipae.cel A&E Symbols (See Attachment 2-9)

The libraries cipeutil.cel and cipputil.cel are provided for showing existing utilities and proposed utilities on pipeline project drawings. The library cipae.cel provides common symbols used by all disciplines on A&E facility drawings. The common symbols include items such as the north arrow, section cut symbols, column balloons, common material symbols and graphic scales. These libraries are provided to aid the DESIGN CONSULTANTS in producing a uniformity in presentation on the Contract Document drawings. Discipline-specific symbology is left to the discretion of the DESIGN CONSULTANTS. They may use the discipline-specific libraries they customarily use. However, any cell libraries used on the Water CIP are considered to be project deliverables that must be transmitted with the CADD files. As such, the DESIGN CONSULTANT must maintain a log of the cells in each library used by completing a Cell Library Log form for each library. In addition, a Cell Design Log must be completed for each cell used. Prior approval must be obtained from the Water CIP Project Manager for all cells created by the DESIGN CONSULTANT. The Cell Design Log documents the cell's appearance, inherent characteristics and placement instructions. Nested cells are not permitted. The Cell Library Log and Cell Design Log are found in Attachment 2-10.

Cells in design files must maintain their status as a complex element. Complex status should not be dropped unless for a specific reason, such as modifications to the symbol.

2.8 Tag Data

The City is investigating the development of automated techniques for electronically capturing tag data from the CADD files for input into the Documentum Document Management System used by the City. When such techniques are put in place, the DESIGN CONSULTANT will be notified that the use of the tag data functionality of MicroStation is a requirement. Instructions will be provided.

2.9 Plotting

The plotting operation significantly influences the appearance of the finished product.

The DESIGN CONSULTANT produces D-sized sheets for most drawings. The outer edge of the D-sized paper is 34 x 22 inches (the trim line). The size of the plotted border is somewhat smaller, to provide margins.

The Water CIP CADD Coordinator also furnishes a black and white color table, two pen tables for controlling line weight, and two pen tables for screening contours when aerial survey files are used as reference files.

Water CIP personnel must be able to duplicate each CADD mylar by plotting the associated CADD file on the City's system. The DESIGN CONSULTANT should use the Save Settings feature to ensure that the display parameters set for its final mylar plotting is retained when the City makes a duplicate plot on its system for comparison. The two plots must be identical.

2.10 Digital Mapping

2.10.1 Global Origin

Survey control for the Water CIP are established using the global positioning system (GPS). All digital mapping is based on the California Coordinate System Zone 6, NAD83 Coordinate Base. Intergraph design files have a global origin of x = -6165251.6353, y = -1772251.6353, z = +214748.3648 to allow for the NAD83 coordinate values. The numbers are shown in the displayed format. If it is necessary to set the global origin of a file, key in these values with the opposite algebraic sign.

2.10.2 Working Units

Intergraph design file working units are 1, 10, 1000 B i.e., Feet (master units), 10ths of a foot (sub units), and 10000ths of a foot (positional units). Use a ' symbol for foot annotations, and "th" for tenths annotations in the working units tutorial.

(**Note:** These parameters are provided in the cip83...seed files (see Attachment 2-2).

2.10.3 Digital Mapping CADD File Parameters

The appropriate City of San Diego cell library, level structure and seed file parameters are used to place all elements in the design file, with strict adherence to working units and seed file global origin. The base map level structure is found in Attachment 2-4. The most current version of the necessary seed files and cell libraries are obtained from a Water CIP CADD Coordinator.

2.10.4 Quality Control

All graphic elements the project design file must adhere to appropriate MicroStation element definitions to allow for error-free translation of design files from 3D to 2D. If the design file is observed to have incorrect element definitions which produce errors in these 3D-to-2D translations, or produce errors when used with other Intergraph application software, the DESIGN CONSULTANT must correct any errors or deficiencies in the design file related to incorrect graphic element definitions, etc.

Note: To prevent project delays, the DESIGN CONSULTANT should review each design file using an appropriate file checking program, (i.e., MicroStation EDG, File Fixer, etc.). This helps to identify and correct any element definition and/or design file format errors prior to receipt of the files by the Water CIP.

2.10.5 Water CIP Digital Mapping Deliverables

Digitized graphic data files of topographic mapping for the Water CIP are 3D dgn format for MicroStation software, furnished on CDs prepared according to the ISO 9660 specification. Disks are furnished to the appropriate Water CIP CADD Coordinator with each checkprint, and with the final submittal.

A separate Breakline/Spot elevation XYZ file is provided which contains all planimetric and topographical features necessary to create an accurate digital terrain model (DTM) of the mapping area, also in MicroStation 3D dgn format. The contours are generated from this DTM data.

2.11 Geographic Information System

The Water Department plans to automate the process of electronically capturing GIS information from the CADD drawing files and entering that information into its GIS system. When the automation process is complete, the DESIGN CONSULTANTS will be notified of the necessary formatting requirements for the electronic capture of specific GIS information.

Currently, information is entered manually into the Water Department's GIS database from information gathered from CIP drawings. To aid in this process, CADD drawings should include the type, size, materials used, exact location and other information applicable to the installation and maintenance of all Water facilities, including the following: air valves, back flows, blow offs, hydrants, mains, meters, regulating valves, system/isolation valves, and services. When construction options have been given, the final as-built drawings must reflect the exact field conditions.

2.12 Quality Requirements

The following requirements apply to all CADD files produced for the Water CIP.

2.12.1 Quality Assurance/Quality Control

DESIGN CONSULTANTS are responsible for performing Quality Assurance/Quality Control procedures to ensure that they and their subconsultants adhere to the Water CIP CADD Standards. A program such as "SpecChecker" by Axiom should be used to electronically detect and correct MicroStation user errors. Problems encountered by DESIGN CONSULTANTS in adhering to the CADD Standards are to be brought to the attention of the appropriate Water CIP CADD Coordinator.

The Water CIP CADD Coordinator audits each DESIGN CONSULTANT's electronic output at least twice over the contract period. The Water CIP CADD Coordinator addresses any deviations by the DESIGN CONSULTANT from the Water CIP CADD Standards. The Water CIP CADD Coordinator reports audit findings to the appropriate Water CIP Project Manager.

2.12.2 Translated Files

Translated CADD files must meet the same quality requirements as CADD files created with MicroStation. Any unusual or abnormal characteristics will render a design file unacceptable. The following points are examples of quality requirements.

1. Working unit resolution must be correct. Elements must be at a reasonable scale. Round-off problems can occur when going from less precise decimal-number systems to the Intergraph integer-accuracy system.

2. Complex elements must be preserved. A file consisting of all line segments is unacceptable. Typical complex elements are cells, text, line strings, blocks, shapes, circles, ellipses and arcs.

3. Closed shapes must be closed precisely.

4. Line strings and curve strings must match precisely at each vertex and each string must be formed as a continuous, complex element.

5. Elements filled with color must use the “fill” parameter. The use of multiple elements to create solid area fill is unacceptable.

6. The text font and size requirements must be preserved in the translation set forth in Sections 2.6.6 and 2.6.7 of the Water CIP CADD Standards. Text that does not fit into shapes, but is obviously too large or too small in the context of the drawing, is unacceptable. Text must come out as MicroStation Font 1.

7. Most CADD systems have the flexibility to organize data. These methods must be successfully translated into levels and graphic groups that are consistent with the discipline level logs.

8. Color, line weight, line style and area patterning must be translated.

9. If a special symbol font is used by the original CADD system, a corresponding symbol font must be created for the MicroStation design files after translation.

10. There must be no graphic elements outside the drawing prior to translation.

2.13 Transmittal

The following requirements apply to the final submittal of all Contract Document drawings and associated CADD files.

2.13.1 Preparation for Transmittal

The DESIGN CONSULTANT may not transmit unnecessary files. Transmitted files must contain no deleted elements and no empty bytes. All files must be compressed.

The following format applies to Contract Document drawing files. Only views one and five are turned on. View one is a close-up of the title block with text that identifies the drawing. View

five is an overview of the entire drawing. Plotting parameters are displayed outside the border. Any levels that are not part of the final drawing are turned off. The text node display is turned off.

2.13.2 CADD Transmittal Form

The DESIGN CONSULTANT must include a CADD File Transmittal Form (Attachment 2-11) with every delivery of computer files and CADD plots. The Document Control Number box on the form is for Water Department use only and should be left blank. Consultant, date, site, contract and task are for identification. Media type and count are for verification that all tapes or discs, arrived.

Each file name, drawing number (contract design document number from the title block), if any, its transmittal status (preliminary, final, revised), and the size of the plot transmitted (if any) is written in the areas provided on the CADD File Transmittal Form. The full device/directory path is given for each file name. Additional forms should be used if the length of information about transmitted files makes this necessary.

The DESIGN CONSULTANT also attaches a computer printout to the transmittal form showing the file name, size in bytes or blocks, and date last modified for each file. The DESIGN CONSULTANT verifies that the list of files on the transmittal form agrees with the list of files on the computer printout. Both lists are required and must be submitted together.

2.13.3 CADD Acceptance Form

Each Water CIP Project Manager receives each delivery from the DESIGN CONSULTANTS according to the procedure shown on the CADD File Acceptance Form (Attachment 2-12). A copy of the completed form is returned to the DESIGN CONSULTANT. The original is filed with the Water Department.

2.13.4 CADD Transmittal Media

Electronic deliveries to the Water CIP are transmitted on compact discs or tape cartridges. The DESIGN CONSULTANT uses either of these media unless an exception is granted in advance by the appropriate Water CIP CADD Coordinator.

Specifications for Compact Disc:

- Name: A CD-ROM (also known as a data CD) is a compact disc used to store computer data.
- Made so that the disc can be read by any Windows operating software (Windows95, 98, NT).

Specifications for the QIC-80 Format Tape:

- Made so that the tape can be read using a Colorado 350 tape drive

Alternative Media:

- A 100MB ZIP disc may be used as an alternate medium. Prior written permission must be obtained from the Water CIP before a ZIP disc can be used.

2.13.5 Media Labels

The DESIGN CONSULTANT furnishes a permanent label on each tape cartridge or disc which clearly shows the following information:

- Consultant, Site, Contract, Task
- Date
- Item within total count (for example, 2 of 5)
- System used to create the delivery
- Information needed to retrieve files, including command and device/directory

2.13.6 Transmittal Package

The following is a summary of the items mentioned throughout the CADD Standards that the DESIGN CONSULTANT must deliver to the appropriate Water CIP Project Manager. The applicability of each item in the list depends on the scope and nature of the CADD work done by the DESIGN CONSULTANT. In cases of doubt, the material should be transmitted to the Water CIP Project Manager for evaluation.

- Mylar plots with original signatures and seals
- MicroStation format Contract Document drawing file corresponding to each plot
- MicroStation format design files used as reference files
- Plotting parameter files of all types
- Font libraries (if different from Water Department libraries)
- Cell libraries
- Patterning libraries
- Color tables
- Aerial survey contour map files with corresponding X, Y, Z point coordinates in ASCII files
- All parameter files associated with the use of Intergraph application software
- Forms, as shown in the Appendices:
  - Design File Log (Attachment 2-1)
  - Cell Library Log (Attachment 2-10)
  - Cell Design Log (Attachment 2-10)
  - CADD File Transmittal (Attachment 2-11)
- Acceptable media (CD, tape, disk) with label

2.14 References

CADD Text and Symbol Standards
Water and Wastewater Facilities Division, Engineering and Capital Improvements Department

Book 5, Chapter 3, General Drafting Standards
Water CIP Program

ISO 9000

Attachment 2-1
Design File Log (Front and Back)

DESIGN FILE LOG

WATER DEPARTMENT
City of San Diego

File Name _____
Description _____
Directory _____
Project Name/No. _____
Project Engineer _____

Lv	Co	Wt	Lc	Level Description	Lv	Co	Wt	Lc	Level Description
1					33				
2					34				
3					35				
4					36				
5					37				
6					38				
7					39				
8					40				
9					41				
10					42				
11					43				
12					44				
13					45				
14					46				
15					47				
16					48				
17					49				
18					50				
19					51				
20					52				
21					53				
22					54				
23					55				
24					56				
25					57				
26					58				
27					59				
28					60				
29					61				
30					62				
31					63				
32									

Reference Files

No.	Logical Directory	File Name	Logical Name	Description	No.	Logical Directory	File Name	Logical Name	Description
1					17				
2					18				
3					19				
4					20				
5					21				
6					22				
7					23				
8					24				
9					25				
10					26				
11					27				
12					28				
13					29				
14					30				
15					31				
16					32				

Plotting

Queue:	__ Plotter	__ Laser a	__ Laser b
Size:	__ 8.5 x 11	__ 11 x 17	__ 22 x 34
Scale:	__ 1 : 1	__ 2 : 1	__ _____
Pen Table:	__ _____		__ _____
Color Table:	__ sdcolor.tbl	__ None	

Patterning

LV	PS	PA	PD	Cell Lib	Pattern	Description

Saved Views / Miscellaneous

REVERSE SIDE OF DESIGN FILE LOG

Attachment 2-2
CADD Files Available to Design Consultants

CITY CADD FILES AVAILABLE TO DESIGN CONSULTANTS					
File Name	Description			Usage	Assoc. Lib.
	Type	Dim.	Working Units		
cip832d.dgn cip833d.dgn cipb101.dgn cipbpp.dgn	NAD83 NAD83 Border, Plan/Profile Template	2D 3D 2D	1:10:1000 1:10:1000 1:10:1000 1:10:1000	Pipeline Drawings (Plan and Profiles) Aerial Surveys Civil Site, INROADS	cipeutil.cel cipputil.cel
cips1282.dgn cips1283.dgn cipb128.dgn cipcovae.dgn	Seed Seed Border A&E Dwg. Set Cov. Sheet	2D 3D 2D	1:12:8000 1:12:8000 1:12:8000 1:12:8000	A&E Architectural, Structural Design Files Mechanical, Electrical Design Files	cipae.cel
cips1212.dgn cips1213.dgn cipb121.dgn	Seed Seed Border	2D 3D 2D	1:12:1000 1:12:1000 1:12:1000	General Drawings, Non-Scaled, Figures Process, Instrumentation, One-Line Schematics	
sdcolor.tbl sdfont.rsc	City color table City font library			All CADD files All CADD files	

Attachment 2-3
Seed File Defaults and Parameters
(cip833d.dgn, cip832d.dgn)

SEED FILE DEFAULTS AND PARAMETERS

(cip833d.dgn, cip832d.dgn)

		Default Value	Description
Text	Font Height Width	1 4.8 4.8 Embedded	Working Font 40 Scale (.12 Actual) 40 Scale (.12 Actual)
Working Units	Master Unit Sub Unit th Per '	' th 10	Foot tenth
Coordinate Readout	Format Accuracy	MU 0.12	Master Unit 2 Decimals
Angles	Format Mode Accuracy	DDMMSS Bearing 0	Degrees:Minutes:Seconds
Line Type		0	Solid
Color		2	Green
Color Table		sdcolor.tbl	City Color Table
Cell Library		cipeutil.cel	Existing Cell Library
Global Origin	NAD83	-6165251.6353 -1772251.6353 214748.36	
View Attributes	Area Fill Dimension Dynamics Grid Line Weights Patterns Text Other attrib.	On On On On On On On Off	
Dimension Text Format	-Format -AEC Labels -Units -English	AEC x1/2' English 0.12	
Angles	-Accuracy -Display -Measure	0 DDMMSS Degrees	Degrees:Minutes:Seconds
Custom Terminators	-Arrow	C;Font 102	

Attachment 2-4
The City of San Diego Level Structure

THE CITY OF SAN DIEGO LEVEL STRUCTURE

JANUARY 1998

LV	CO	WT	LC	TX WT	LEVEL DESCRIPTION
1	X	X	X	1	PROJECT SPECIFIC - CITY USE ONLY
2	X	X	X	1	CAUTION CALL-OUT, DETAILS AND CONSTUCTION NOTES
3	X	X	X	1	PROJECT SPECIFIC - CITY USE ONLY
4	4	0	6,0	1	LOT SPLITS W/TEXT , LOT LINES W/TEXT
5	6	3	0	1	STREET RIGHT OF WAY W/TEXT
6	3	0	4	1	STREET C/L W/TEXT
7	4	0	3	1	EASEMENTS W/TEXT
8	2	0	2	1	FIELD TRAVERSE W/MONS. W/TEXT
9	0	2	0	1	AERIAL CONTROL POINTS (PANELS) W/TEXT
10	1	0	0,3	1	MINOR CONTOURS (OBSCURED IC = 3)
11	0	0	0	1	MINOR CONTOUR ANNOTATIONS
12	2	2	0,3	1	MAJOR CONTOURS (OBSCURED IC = 3)
13	0	0	0	1	MAJOR CONTOUR ANNOTATIONS
14	0	0	0	1	SPOT ELEVATIONS W/TEXT
15	0	0	0	1	FENCES, RET. WALLS, BARRIERS W/TEXT
16	0	0	0	1	EDGE OF PAVEMENT, CURB, GUTTER, SIDEWALK W/TEXT
17	0	0	0	1	BUILDING OUTLINES, STRUCTURES W/TEXT
18	0	0	3	1	UNIMPROVED ROAD, PATH W/TEXT
19	1	0	6	1	NATURAL STREAM F/L'S AND WATER BODIES
20	1	1	3	1	G.V'S. FH'S, WATER MAINS (ASSOCIATED TEXT IV = 24)
21	1	1	3	1	WATER METERS AND SERVICES W/TEXT
22	2	1	7	1	SEWER MANHOLES AND MAINS (ASSOCIATED TEXT IV = 25)
23	2	1	7	1	SEWER CLEAN-OUTS AND LATERALS W/TEXT
24	1	1	0	1	ANNOTATION FOR EXISTING WATER
25	2	1	0	1	ANNOTATION FOR EXISTING SEWER
26	1	9	0	1	PROPOSED WATER (PLAN) (ASSOCIATED TEXT IV = 28)
27	2	9	0	1	PROPOSED SEWER (PLAN) (ASSOCIATED TEXT IV = 29)
28	1	3	0	3	TEXT FOR PROPOSED WATER
29	2	3	0	3	TEXT FOR PROPOSED SEWER
30	0	0	2	1	STORM DRAIN AND CURB INLETS W/TEXT
31	0	0	0	1	FLOOD CHANNEL, BROW DITCH, BOX CULVERT W/TEXT

THE CITY OF SAN DIEGO LEVEL STRUCTURE

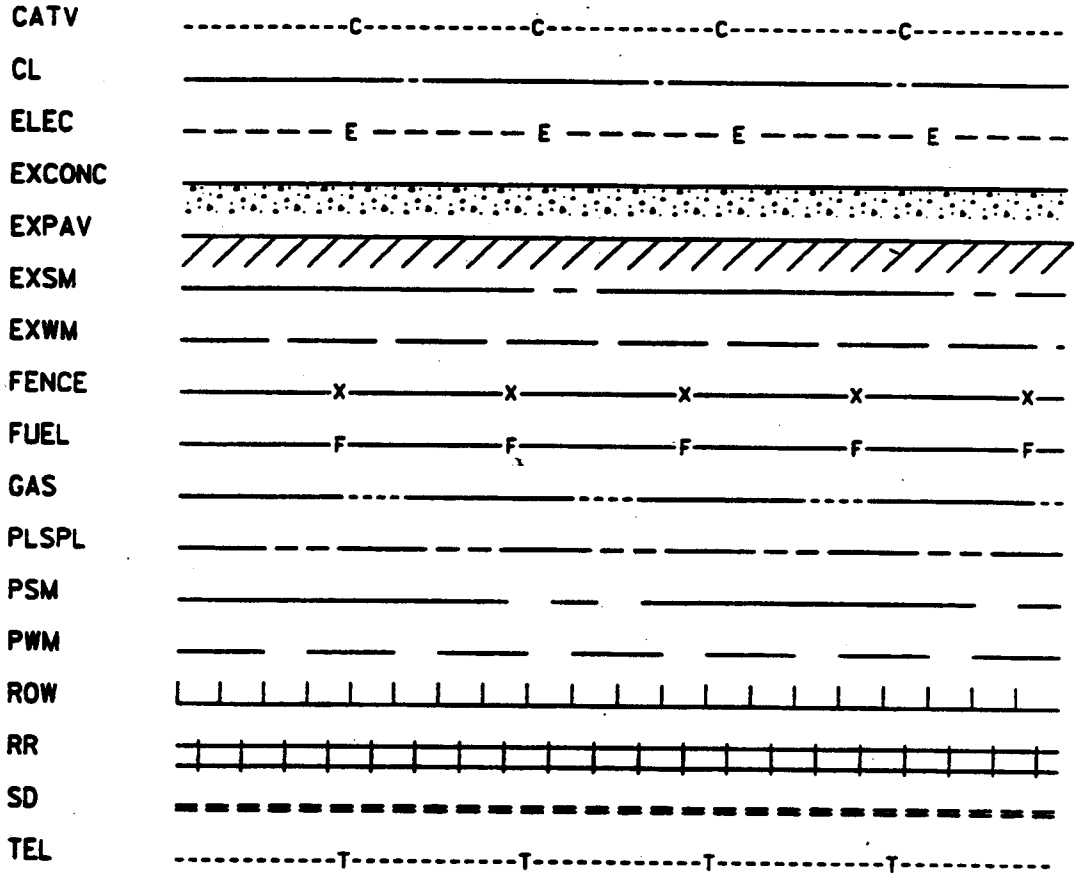
JANUARY 1998

LV	CO	WT	LC	TX WT	LEVEL DESCRIPTION
32	0	0	0	1	SIDEWALK UNDERDRAIN, SLOTTED DRAINS W/TEXT
33	7	0	2	1	HEAD WALLS, MISC DRAINAGE FIXTURES W/TEXT
34	0	0	0,2	1	PAINTED TRAFFIC STRIPING W/TEXT
35	3	0	0,2	1	TRAFFIC SIGNALS, STANDARDS, SIGNAL BOXES W/TEXT
36	4	1	0,2	1	PAINTED C/L DOUBLE YELLOW LINE W/TEXT
37	3	0	0,2	1	STREET LIGHT STANDARD W/TEXT
38	3	0	0,2	1	STREET LIGHT PULLBOX W/TEXT
39	0	1	0	1	BRIDGES: ABUTMENTS, ETC., W/TEXT
40	3	0	2	1	ELECTRICAL LINES AS MARKED W/TEXT
41	4	0	6	1	GAS LINES, VAULTS, METERS W/TEXT
42	6	0	2	1	TELEPHONE AND APPURTENANCES W/TEXT
43	6	0	2	1	CABLE TX BOXES, W/TEXT
44	6	0	2	1	STEAM/CHILLED WATER LINES W/TEXT
45	5	0	0	1	RAILROAD AND TROLLEY LINES W/TEXT
46	X	X	X		PROJECT SPECIFIC - CITY USE ONLY
47	X	X	X		PROJECT SPECIFIC - CITY USE ONLY
48	X	X	X		PROJECT SPECIFIC - CITY USE ONLY
49	X	X	X		PROJECT SPECIFIC - CITY USE ONLY
50	2	0	0	1	TREES, BUSHES, ETC., W/TEXT
51	0	1	5	1	RECREATION AREA AND MISC. BOUNDARIES W/TEXT
52	0	0	0	1	SIGNS, MAIL BOXES, STATUES W/TEXT
53	1	0	0	1	SPRINKLER, BACKFLOW AND WATER RISER W/TEXT
54	X	X	X	1	SURVEY NOTES PLACED ON THE CONSTRUCTION CLASS
55	X	X	X	1	SURFACE ZERO TRIANGLES
56	X	X	X		PROJECT SPECIFIC - CITY USE ONLY
57	X	X	X	1	REFERENCE BOUNDARY LAYOUT
58	5	1	0	1	GRAPHIC SCALE, NORTH ARROW, DIMENSIONS
59	X	X	X	1	COVER SHEET FILE - CITY USE ONLY
60	0	0	1	1	COORDINATE GRID AND LABELS
61	0	0	0	1	LEVEL STRUCTURE
62	0	1	0	1	BORDER AND TITLE BLOCK TEXT
63	3	2	0	1	CONSTRUCTION CHANGE AND REVISIONS

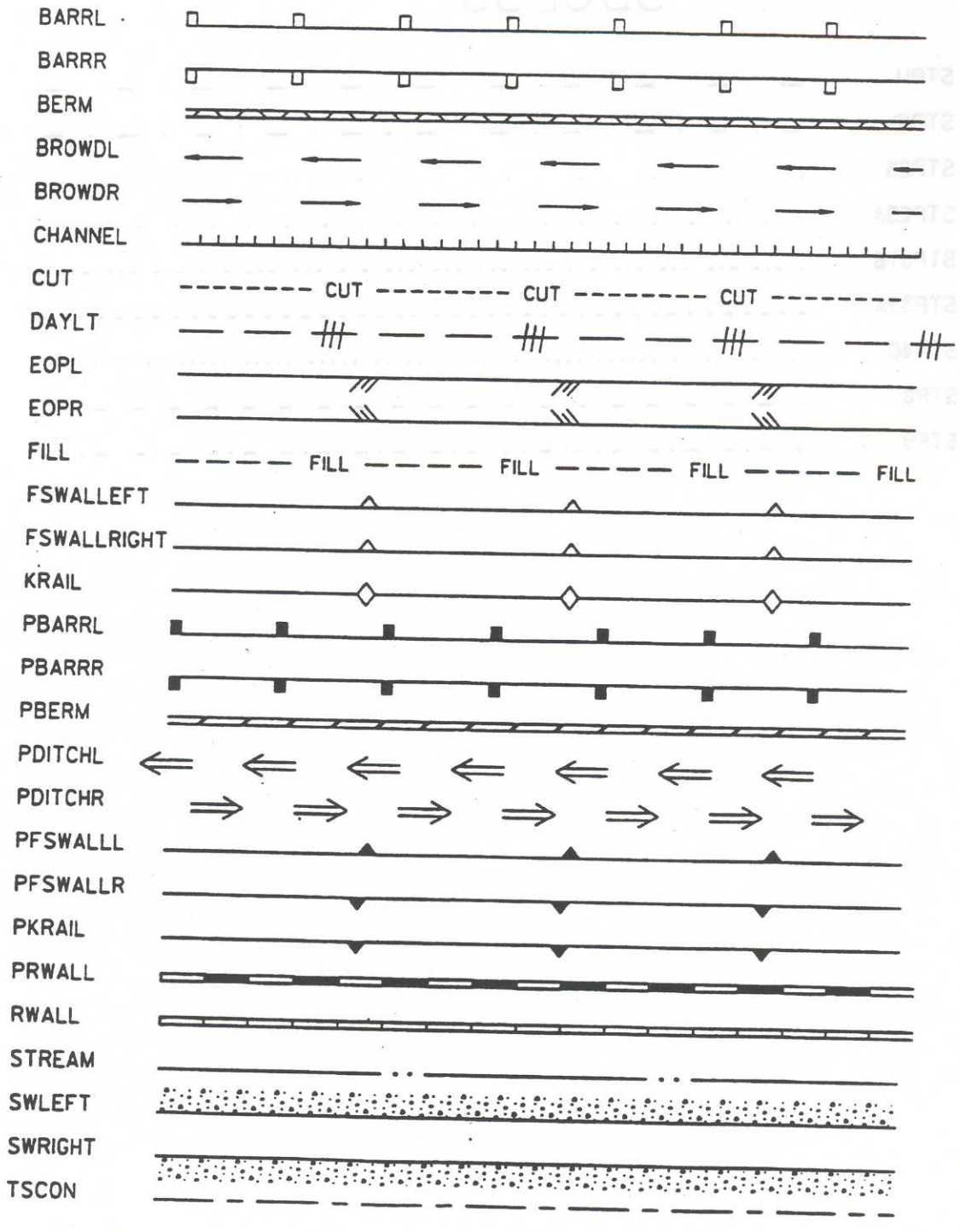
Attachment 2-5
Custom Line Styles

CUSTOM LINE STYLES

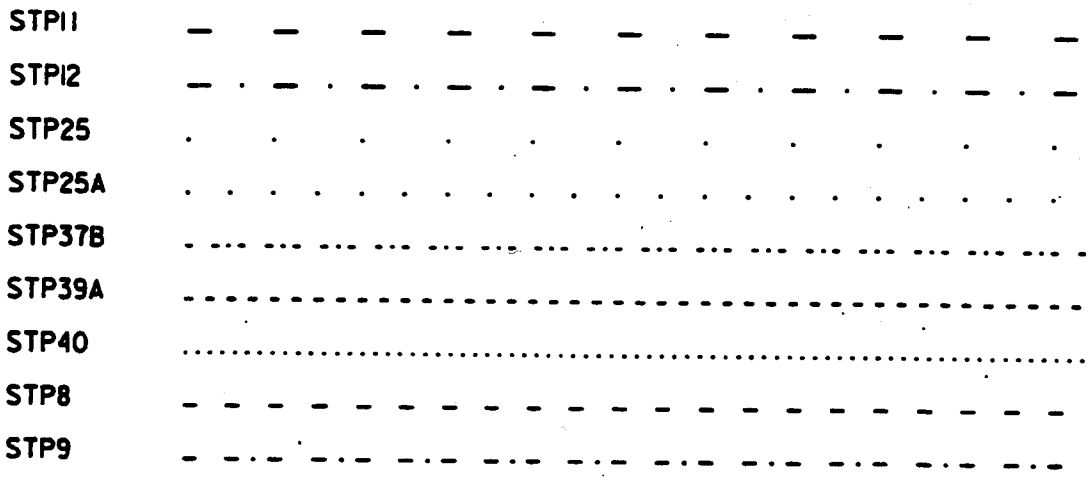
SDCLSI



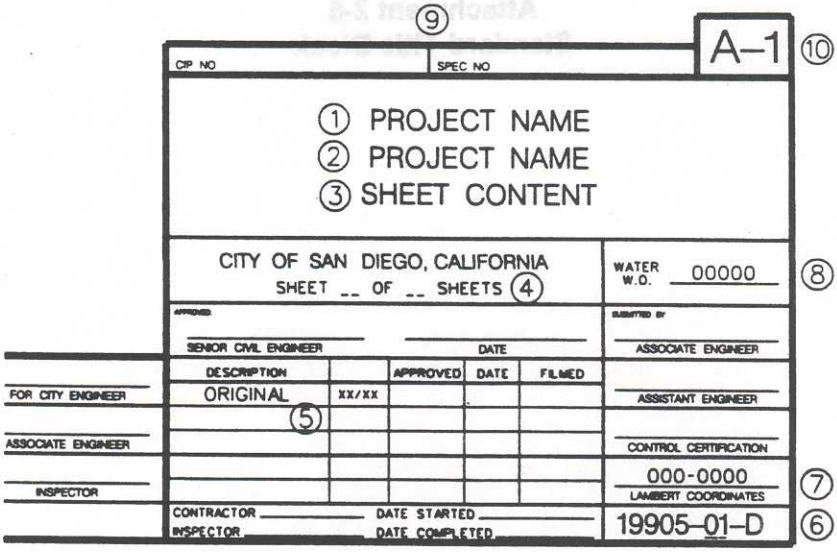
SDCLS2


BARRL
BARRR
BERM
BROWDL
BROWDR
CHANNEL
CUT
CUT
CUT
CUT
DAYLT
EOPL
EOPR
FILL
FILL
FILL
FILL
FILL
FSWALLEFT
FSWALLRIGHT
KRAIL
PBARRL
PBARRR
PBERM
PDITCHL
PDITCHR
PFSWALLL
PFSWALLR
PKRAIL
PRWALL
RWALL
STREAM
SWLEFT
SWRIGHT
TSCON

SDCLS3



Attachment 2-6
Standard Title Block



NOTE: ALL TEXT SIZES ARE SCALE 1:1

① TITLE BLOCK LINE #1 (COVER & PLAN VIEW SHEET)
COVER SHEET: same title as in CIP Budget Book (maximum four lines)
PLAN VIEW SHEET: project title
FT=43, TX=.2, WT=3

② TITLE BLOCK LINE #2 (PLAN VIEW SHEET ONLY)
street name
FT=43, TX=.2, WT=3

③ TITLE BLOCK LINE #3 (PLAN VIEW SHEET ONLY)
street limits
FT=43, TX=.2, WT=3

④ CITY SHEET NUMBERS:
number of current sheet and total number of sheets
FT=1, TX=.10, WT=0

⑤ DESCRIPTION BLOCK:
For original issue, revisions and as-builts. Refer to E&D department instructions for more information
FT=1, TX=.12, WT=1

⑥ CITY DRAWING NUMBER:
from Maps and Records in E&D department
FT=43, TX=.2, WT=1

⑦ LAMBERT COORDINATES:
most southwesterly coordinates of the 100' scale map
FT=1, TX=.12, WT=1

⑧ WORK ORDER NUMBER:
from design engineer. consistent with cover sheet requirements
FT=1, TX=.12, WT=1

⑨ CIP / SPECIFICATION NUMBER:
Assigned by CIP project manager
FT=1, TX=.10, WT=0

⑩ INTERNAL SHEET NUMBER:
For use by design consultant
FT=43, TX=.32, WT=2

Attachment 2-7
Cell Library: Existing Utilities (cipeutil.cel)

Date: 15 1999

TABLE OF CONTENTS

EXFH	EX. FIRE HYDRANT	1
EXWAMH	EX. ACCESS WATER MH	1
EXWAV	EX. WATER AIR VALVE	1
EXWBO	EX. BLOW OFF	1
EXWM	EX. WATER METER	1
EXWRED	EX. REDUCER	1
EXWGV	EX. WATER GATE VALVE	1
EXMHP	EX. MANHOLE PROFILE	1
EXABMH	EX. ABANDONED MH	1
EXDPMH	EX. DROP MANHOLE	1
EXMH	EX. SWR MANHOLE OR CO	1
EXSPLG	EX. SEWER PLUG	1
SD4CO	SD 4 TYPE A C.O.	1
SD5CO	SD 5 C.O.	1
SD6CO	SD 6 TYPE A C.O.	1
SD7CO	SD 7 TYPE A C.O.	2
SD8CO	SD 8 TYPE A C.O.	2
SD9CO	SD 9 TYPE B C.O.	2
SDACI	SD 10 TYPE A C.I.	2
SDBCI	SD 10 TYPE B C.I.	2
SDCCI	SD 10 TYPE C C.I.	2
SDFCB	SD 5 TYPE F CB	2
SDJCB	SD TYPE J CB	2
SDICB	SD TYPE I CB	2
GASV	EX. GAS VALVE	2
GASM	EX. GAS METER	2
HH	ELEC. MH HANDHOLD	2
PB	ELEC. PULL BOX	2
PP	ELEC. POWER POLE	2
PPCS	POWER POLE W CABLE SUPP.	2
PPSL	POWER POLE W STREET LIGHT	3
STL	STREET LIGHT	3
TCB	TRAFFIC CONTROL BOX	3
TL	TRAFFIC LIGHT	3
TLA	TRAFFIC LIGHT ACTUATOR	3
XFR	TRANSFORMER	3
TEL	TELEPHONE MH HANDHOLD	3
TP	TELEPHONE POLE	3
BLK	BLOCK NUMBER	3
BLK1	BLOCK 1 NUMBER	3
BLK2	BLOCK 2 NUMBER	3
BLK3	BLOCK 3 NUMBER	3
BUSH	EX. BUSH	3
BUSHL	EX. LONG BUSH	3
CL	CENTERLINE SYMBOL	3
CONC	CONCRETE SYMBOL	4
EDGPAV	EX. EDGE OF PAVEMENT	4
EXGRD	EX. GROUND	4
EXPAV	EX PAVEMENT	4
MARSH	EX. MARSH OR SWAMP	4

Date: 15 Feb 1999

MON	EX. SURVEY MONUMENT	4
OWNLIN	OWNERSHIP LINE	4
PALM	EX. PALM TREE	4
PSCL40	PROFILE SCALE 40	4
PSCL20	PROFILE SCALE 20	4
REF	REFERENCE MAPS AS BUILTS	4
SL	SURVEYLINE SYMBOL	4
TREE	EX. TREE	4
PM	PLUS MINUS	4
EX6WP	EX. 6 WATER PROFILE	4
EX8WP	EX. 8 WATER PROFILE	5
EX10WP	EX. 10 WATER PROFILE	5
EX12WP	EX. 12 WATER PROFILE	5
EX16WP	EX. 16 WATER PROFILE	5
EX20WP	EX. 20 WATER PROFILE	5
EX24WP	EX. 24 WATER PROFILE	5
EX30WP	EX. 30 WATER PROFILE	5
EX36WP	EX. 36 WATER PROFILE	5
EX40WP	EX. 40 WATER PROFILE	5
EX48WP	EX. 48 WATER PROFILE	5
EX54WP	EX. 54 WATER PROFILE	5
EX6SP	EX. 6 SEWER PROFILE	5
EX8SP	EX. 8 SEWER PROFILE	5
EX10SP	EX. 10 SEWER PROFILE	5
EX12SP	EX. 12 SEWER PROFILE	5
EX18SP	EX. 18 SEWER PROFILE	6
EX21SP	EX. 21 SEWER PROFILE	6
EX24SP	EX. 24 SEWER PROFILE	6
EX27SP	EX. 27 SEWER PROFILE	6
EX30SP	EX. 30 SEWER PROFILE	6
EX33SP	EX. 33 SEWER PROFILE	6
EX36SP	EX. 36 SEWER PROFILE	6
EX60SP	EX. 60 SEWER PROFILE	6
EX66SP	EX. 66 SEWER PROFILE	6
EX87SP	EX. 87 SEWER PROFILE	6
EX96SP	EX. 96 SEWER PROFILE	6
EX108S	EX. 108 SEWER PROFILE	6
SD8PR	EX. 8 SD PROFILE	6
SD12PR	EX. 12 SD PROFILE	6
SD18PR	EX. 18 SD PROFILE	6
SD24PR	EX. 24 SD PROFILE	7
SD30PR	EX. 30 SD PROFILE	7
SD36PR	EX. 36 SD PROFILE	7
SD48PR	EX. 48 SD PROFILE	7
SD54PR	EX. 54 SD PROFILE	7
GASPR	EX. 1.5 GAS PROFILIE	7
GAS6P	EX. 6 HP GAS PROFILIE	7
ELPR	ELEC. PROFILE	7
EL2X2	ELEC. 2X2 DUCTS	7
EL3X2	ELEC. 3X2 DUCTS	7

EL3X3	ELEC. 3X3 DUCTS	----------7
EL3X5	ELEC. 3X5 DUCTS	----------7
EL4X1	ELEC. 4X1 DUCTS	----------7
EL4X3	ELEC. 4X3 DUCTS	----------7
EL4X4	ELEC. 4X4 DUCTS	----------7
EL5X5	ELEC. 5X5 DUCTS	----------8
EL5X6	ELEC. 5X6 DUCTS	----------8
EL6X4	ELEC. 6X4 DUCTS	----------8
EL6X6	ELEC. 6X6 DUCTS	----------8
TRFPRO	TRAFFIC PROFILE	----------8
TELPR	TEL. 1 CA PROFILE	----------8
TEL2X2	TEL. 2X2 DUCTS	----------8
TEL3X2	TEL. 3X2 DUCTS	----------8
TEL3X3	TEL. 3X3 DUCTS	----------8
TEL3X5	TEL. 3X5 DUCTS	----------8
TEL4X1	TEL. 4X1 DUCTS	----------8
TEL4X3	TEL. 4X3 DUCTS	----------8
TEL4X4	TEL. 4X4 DUCTS	----------8
TEL5X5	TEL. 5X5 DUCTS	----------8
TEL5X6	TEL. 5X6 DUCTS	----------8
TEL6X6	TEL. 6X6 DUCTS	----------9
TEL6X4	TEL. 6X4 DUCTS	----------9
CTVPED	CABLE TV PEDESTAL	----------9
CTVPR	CABLE TV PROFILE	----------9
TELPED	TELEPHONE PEDESTAL	----------9
LEVEL	LEVEL STRUCTURE 4 94	-------9
EXRMP1	EX. PEDESTRIAN RAMP 1	------9
EXRMP2	EX. PEDESTRIAN RAMP 2	------9
EXCOPF	EX CLEAN OUT PROFILE	-------9
TIC	100 TIC STATION	----------9
TIC2	100 TIC STATION WITH EDIT	--9
HOUSE1	SUB LOT 1	----------9
HOUSE2	SUB LOT 2	----------9
HOUSE3	SUB LOT 3	----------9
FENCE	RIVER FENCE	----------9

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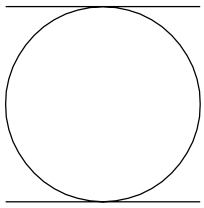
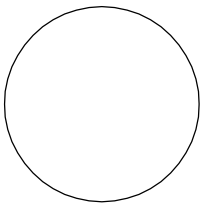
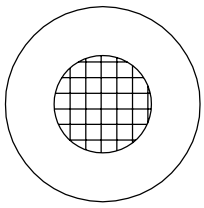
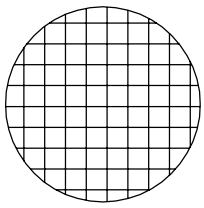
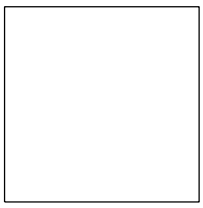
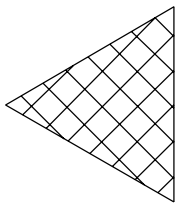
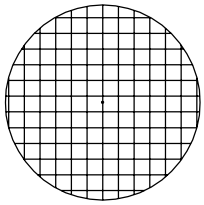
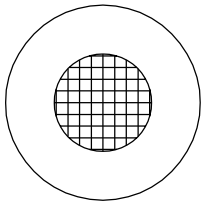
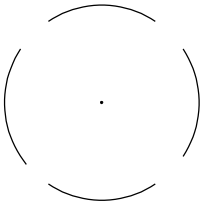
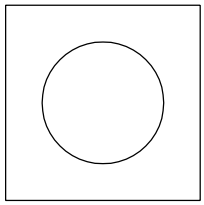
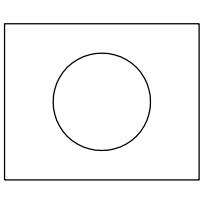
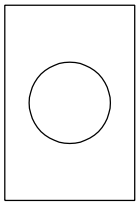
		
Cell Name: EXFH Description: EX. FIRE HYDRANT Cell Type: Graphic Levels: 20	Cell Name: EXWAMH Description: EX. ACCESS WATER MH Cell Type: Graphic Levels: 20	Cell Name: EXWAV Description: EX. WATER AIR VALVE Cell Type: Graphic Levels: 20
		
Cell Name: EXWBO Description: EX. BLOW OFF Cell Type: Graphic Levels: 20	Cell Name: EXWM Description: EX. WATER METER Cell Type: Graphic Levels: 21	Cell Name: EXWRED Description: EX. REDUCER Cell Type: Graphic Levels: 20
		
Cell Name: EXWGV Description: EX. WATER GATE VALVE Cell Type: Graphic Levels: 20	Cell Name: EXMHP Description: EX. MANHOLE PROFILE Cell Type: Graphic Levels: 22	Cell Name: EXABMH Description: EX. ABANDONED MH Cell Type: Graphic Levels: 22
		
Cell Name: EXDPMH Description: EX. DROP MANHOLE Cell Type: Graphic Levels: 22	Cell Name: EXMH Description: EX. SWR MANHOLE OR CO Cell Type: Graphic Levels: 22	Cell Name: EXSPLG Description: EX. SEWER PLUG Cell Type: Graphic Levels: 22
		
Cell Name: SD4CO Description: SD 4 TYPE A C.O. Cell Type: Graphic Levels: 30	Cell Name: SD5CO Description: SD 5 C.O. Cell Type: Graphic Levels: 30	Cell Name: SD6CO Description: SD 6 TYPE A C.O. Cell Type: Graphic Levels: 30

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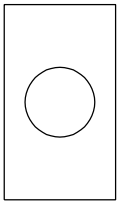
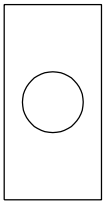
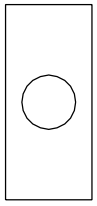
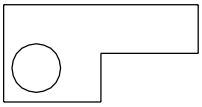
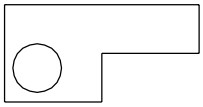
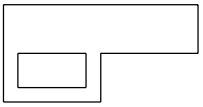
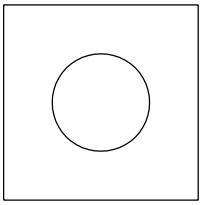
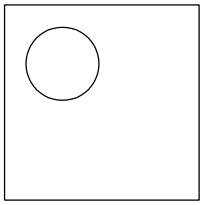
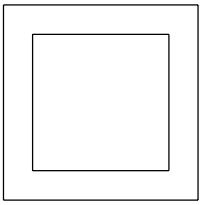
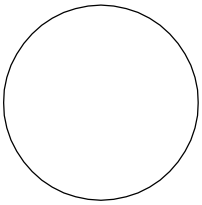
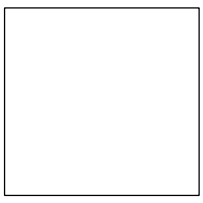
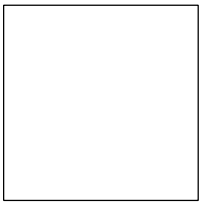
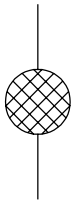
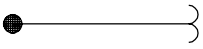
		
Cell Name: SD7CO Description: SD 7 TYPE A C.O. Cell Type: Graphic Levels: 30	Cell Name: SD8CO Description: SD 8 TYPE A C.O. Cell Type: Graphic Levels: 30	Cell Name: SD9CO Description: SD 9 TYPE B C.O. Cell Type: Graphic Levels: 30
		
Cell Name: SDACI Description: SD 10 TYPE A C.I. Cell Type: Graphic Levels: 30	Cell Name: SDBCI Description: SD 10 TYPE B C.I. Cell Type: Graphic Levels: 30	Cell Name: SDCCI Description: SD 10 TYPE C C.I. Cell Type: Graphic Levels: 30
		
Cell Name: SDFCB Description: SD 5 TYPE F CB Cell Type: Graphic Levels: 30	Cell Name: SDJCB Description: SD TYPE J CB Cell Type: Graphic Levels: 30	Cell Name: SDICB Description: SD TYPE I CB Cell Type: Graphic Levels: 30
		
Cell Name: GASV Description: EX. GAS VALVE Cell Type: Graphic Levels: 41	Cell Name: GASM Description: EX. GAS METER Cell Type: Graphic Levels: 41	Cell Name: HH Description: ELEC. MH HANDHOLD Cell Type: Graphic Levels: 40
		
Cell Name: PB Description: ELEC. PULL BOX Cell Type: Graphic Levels: 40	Cell Name: PP Description: ELEC. POWER POLE Cell Type: Graphic Levels: 40	Cell Name: PPCS Description: POWER POLE W CABLE SUP. Cell Type: Graphic Levels: 40

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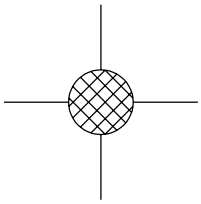
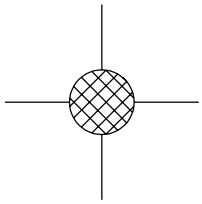
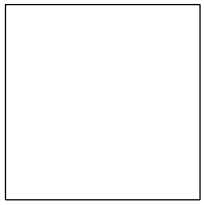


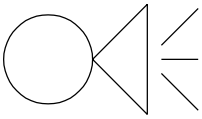
Cell Name: PPSL
Description: POWER POLE W ST LIGHT
Cell Type: Graphic
Levels: 40



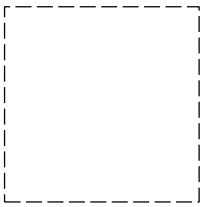
Cell Name: STL
Description: STREET LIGHT
Cell Type: Graphic
Levels: 37



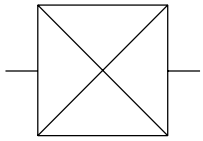
Cell Name: TCB
Description: TRAFFIC CONTROL BOX
Cell Type: Graphic
Levels: 35



Cell Name: TL
Description: TRAFFIC LIGHT
Cell Type: Graphic
Levels: 35

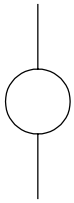


Cell Name: TLA
Description: TRAFFIC LIGHT ACTUATOR
Cell Type: Graphic
Levels: 35

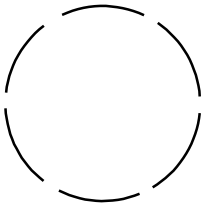


Cell Name: XFR
Description: TRANSFORMER
Cell Type: Graphic
Levels: 40

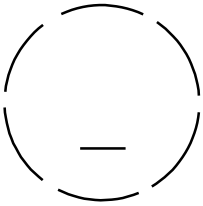
Cell Name: TEL
Description: TELEPHONE MH HANDHOLD
Cell Type: Graphic
Levels: 42



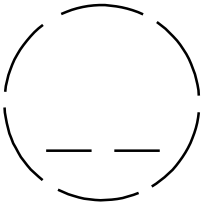
Cell Name: TP
Description: TELEPHONE POLE
Cell Type: Graphic
Levels: 42



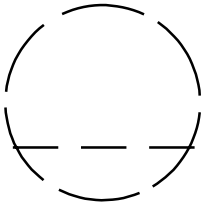
Cell Name: BLK
Description: BLOCK NUMBER
Cell Type: Graphic
Levels: 4



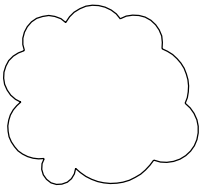
Cell Name: BLK1
Description: BLOCK 1 NUMBER
Cell Type: Graphic
Levels: 4



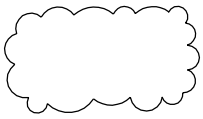
Cell Name: BLK2
Description: BLOCK 2 NUMBER
Cell Type: Graphic
Levels: 4



Cell Name: BLK3
Description: BLOCK 3 NUMBER
Cell Type: Graphic
Levels: 4



Cell Name: BUSH
Description: EX. BUSH
Cell Type: Graphic
Levels: 50



Cell Name: BUSHL
Description: EX. LONG BUSH
Cell Type: Graphic
Levels: 50

Cell Name: CL
Description: CENTERLINE SYMBOL
Cell Type: Graphic
Levels: 6

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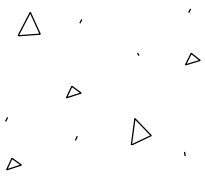
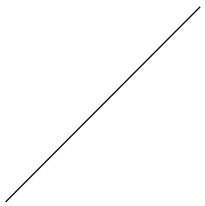
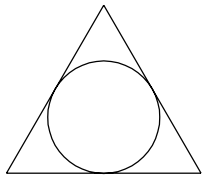
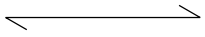
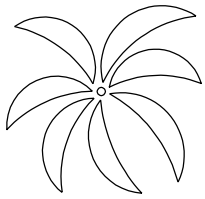
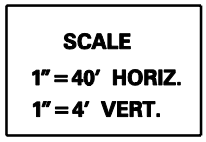
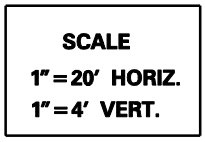
		
Cell Name: CONC Description: CONCRETE SYMBOL Cell Type: Graphic Levels: 16	Cell Name: EDGPAV Description: EX. EDGE OF PAVEMENT Cell Type: Graphic Levels: 16	Cell Name: EXGRD Description: EX. GROUND Cell Type: Graphic Levels: 18
		
Cell Name: EXPAV Description: EX PAVEMENT Cell Type: Graphic Levels: 16	Cell Name: MARSH Description: EX. MARSH OR SWAMP Cell Type: Graphic Levels: 19	Cell Name: MON Description: EX. SURVEY MONUMENT Cell Type: Graphic Levels: 8
		
Cell Name: OWNLIN Description: OWNERSHIP LINE Cell Type: Graphic Levels: 4	Cell Name: PALM Description: EX. PALM TREE Cell Type: Graphic Levels: 50	Cell Name: PSCL40 Description: PROFILE SCALE 40 Cell Type: Graphic Levels: 2
		
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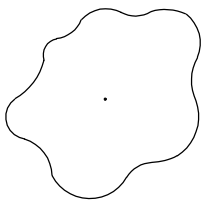	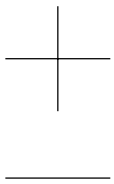	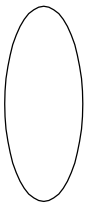
Cell Name: TREE Description: EX. TREE Cell Type: Graphic Levels: 50	Cell Name: PM Description: PLUS MINUS Cell Type: Graphic Levels: 2	Cell Name: EX6WP Description: EX. 6 WATER PROFILE Cell Type: Graphic Levels: 20

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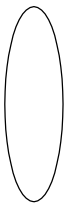	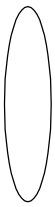	
Cell Name: EX8WP Description: EX. 8 WATER PROFILE Cell Type: Graphic Levels: 20	Cell Name: EX10WP Description: EX. 10 WATER PROFILE Cell Type: Graphic Levels: 20	Cell Name: EX12WP Description: EX. 12 WATER PROFILE Cell Type: Graphic Levels: 20
		
Cell Name: EX16WP Description: EX. 16 WATER PROFILE Cell Type: Graphic Levels: 20	Cell Name: EX20WP Description: EX. 20 WATER PROFILE Cell Type: Graphic Levels: 20	Cell Name: EX24WP Description: EX. 24 WATER PROFILE Cell Type: Graphic Levels: 20
		
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		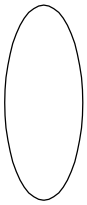
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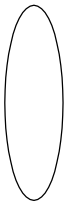	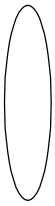	
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Cell Name: EX18SP Description: EX. 18 SEWER PROFILE Cell Type: Graphic Levels: 22	Cell Name: EX21SP Description: EX. 21 SEWER PROFILE Cell Type: Graphic Levels: 22	Cell Name: EX24SP Description: EX. 24 SEWER PROFILE Cell Type: Graphic Levels: 22
		
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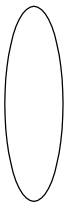		
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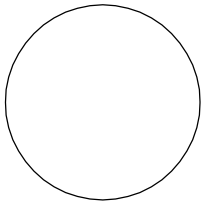
Cell Name: SD24PR Description: EX. 24 SD PROFILE Cell Type: Graphic Levels: 30	Cell Name: SD30PR Description: EX. 30 SD PROFILE Cell Type: Graphic Levels: 30	Cell Name: SD36PR Description: EX. 36 SD PROFILE Cell Type: Graphic Levels: 30
		
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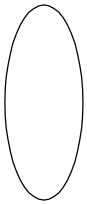	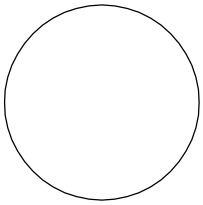	
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	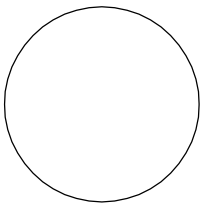	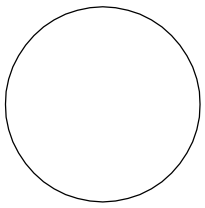
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	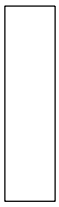	
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	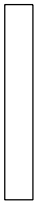	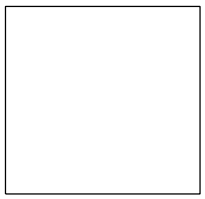
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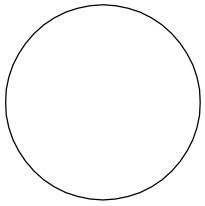	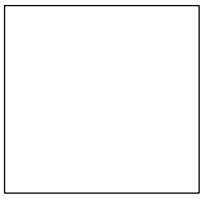	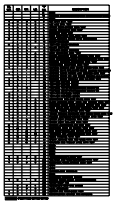
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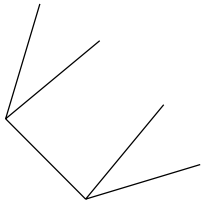
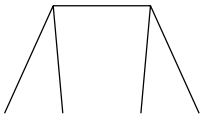
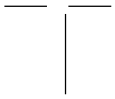
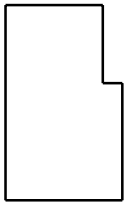
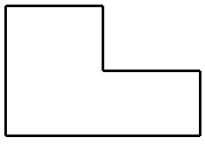
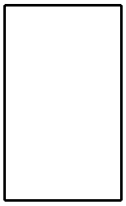
		
Cell Name: EXRMP1 Description: EX. PEDESTRIAN RAMP 1 Cell Type: Graphic Levels: 16	Cell Name: EXRMP2 Description: EX. PEDESTRIAN RAMP 2 Cell Type: Graphic Levels: 16	Cell Name: EXCOPF Description: EX CLEAN OUT PROFILE Cell Type: Graphic Levels: 22,27
		
Cell Name: TIC Description: 100 TIC STATION Cell Type: Graphic Levels: 6	Cell Name: TIC2 Description: 100 TIC STATION W EDIT Cell Type: Graphic Levels: 6	Cell Name: HOUSE1 Description: SUB LOT 1 Cell Type: Graphic Levels: 12
		
Cell Name: HOUSE2 Description: SUB LOT 2 Cell Type: Graphic Levels: 12	Cell Name: HOUSE3 Description: SUB LOT 3 Cell Type: Graphic Levels: 12	Cell Name: FENCE Description: RIVER FENCE Cell Type: Graphic Levels: 6

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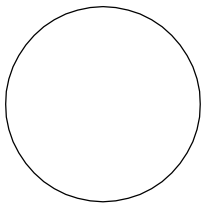	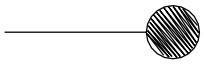	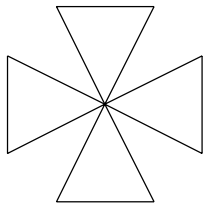
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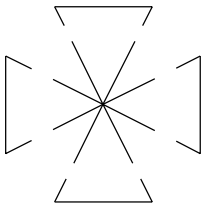
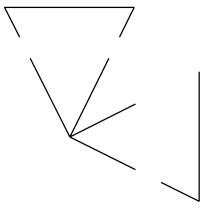
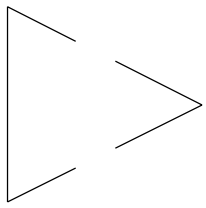
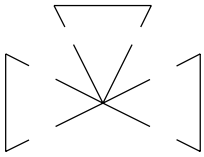
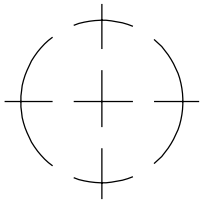
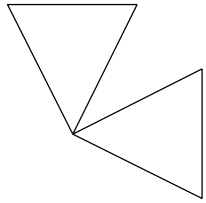
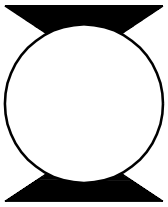
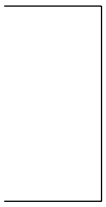
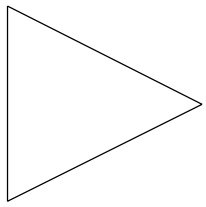
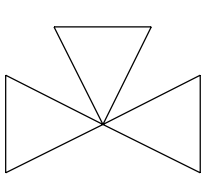
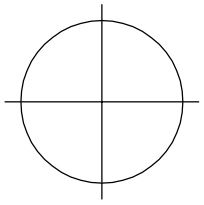
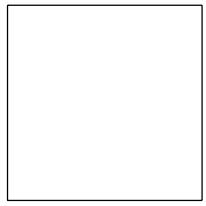
		
Cell Name: PDCROS Description: PROP. DASHED CROSS Cell Type: Graphic Levels: 26	Cell Name: PDE90 Description: PROP. DASHED ELBOW 90 Cell Type: Graphic Levels: 26	Cell Name: PDRED Description: PROP. DASHED REDUCER Cell Type: Graphic Levels: 26
		
Cell Name: PDTEE Description: PROP. DASHED TEE Cell Type: Graphic Levels: 26	Cell Name: PDV Description: PROP. DASHED VALVE Cell Type: Graphic Levels: 26	Cell Name: PEL90 Description: PROP. ELBOW 90 Cell Type: Graphic Levels: 26
		
Cell Name: PFH Description: PROP. FIRE HYDRANT Cell Type: Graphic Levels: 26	Cell Name: PLUG Description: PROP. WATER PLUG Cell Type: Graphic Levels: 26	Cell Name: PRED Description: PROP. REDUCER Cell Type: Graphic Levels: 26
		
Cell Name: PTEE Description: PROP. TEE Cell Type: Graphic Levels: 26	Cell Name: PV Description: PROP. VALVE Cell Type: Graphic Levels: 26	Cell Name: PWMB Description: PROP. WATER METER Cell Type: Graphic Levels: 26

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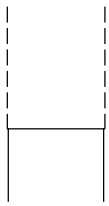
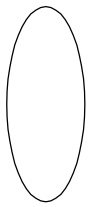
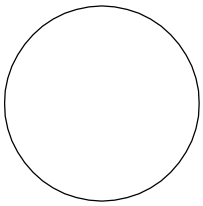
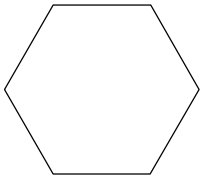
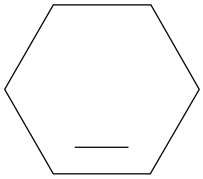
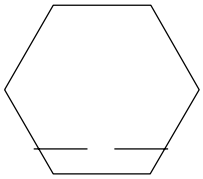
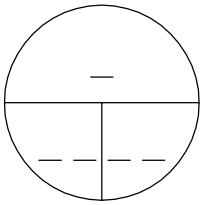
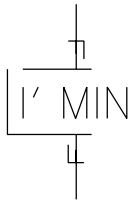
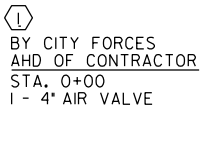
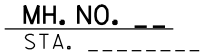
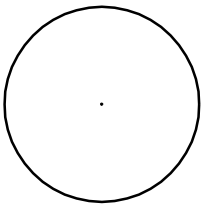
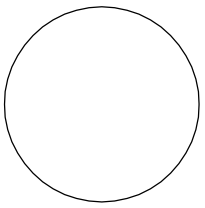
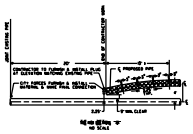
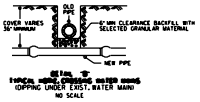
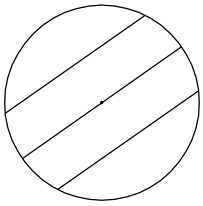
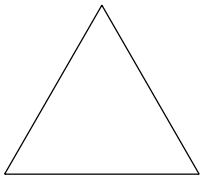
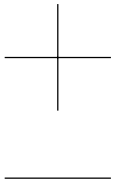
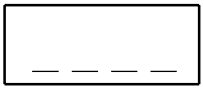
		
Cell Name: PAMHP Description: PROP. ACCESS MH PROFILE Cell Type: Graphic Levels: 26	Cell Name: PBOP Description: PROP. BLOW OFF PROFILE Cell Type: Graphic Levels: 26	Cell Name: PW6PR Description: PROP. 6 WATER PROFILE Cell Type: Graphic Levels: 26
		
Cell Name: PW8PR Description: PROP. 8 WATER PROFILE Cell Type: Graphic Levels: 26	Cell Name: PW10PR Description: PROP. 10 WATER PROFILE Cell Type: Graphic Levels: 26	Cell Name: PW12PR Description: PROP. 12 WATER PROFILE Cell Type: Graphic Levels: 26
		
Cell Name: PW24PR Description: PROP. 24 WTR PROFILE Cell Type: Graphic Levels: 26	Cell Name: PWGB Description: PROP. WATER GRADE BREAK Cell Type: Graphic Levels: 26	Cell Name: HEX Description: HEX FOR NOTES BLANK Cell Type: Graphic Levels: 28
		
Cell Name: HEX1 Description: HEX FOR NOTES 1 Cell Type: Graphic Levels: 28	Cell Name: HEX2 Description: HEX FOR NOTES 2 Cell Type: Graphic Levels: 28	Cell Name: CFNOTE Description: CITY FORCES CALL OUT Cell Type: Graphic Levels: 2
		
Cell Name: MIN Description: 1 MINIMUM CLEARANCE Cell Type: Graphic Levels: 33,47	Cell Name: CF Description: WORK BY CITY FORCES Cell Type: Graphic Levels: 28	Cell Name: CT Description: WORK BY CONTRACTOR Cell Type: Graphic Levels: 28

		
Cell Name: PWGBE Description: PROP WTR GRADE BRK ELEV Cell Type: Graphic Levels: 33	Cell Name: PS Description: PROP. SEWER MAIN Cell Type: Graphic Levels: 27	Cell Name: PSLIN Description: PROP. SEWER LINED Cell Type: Graphic Levels: 27
		
Cell Name: PMHCAL Description: PROP. MH CALL OUT Cell Type: Graphic Levels: 29	Cell Name: PMHPL Description: PROP. MH Cell Type: Graphic Levels: 27	Cell Name: PSGBK Description: PROP. SEWER GRADE BREAK Cell Type: Graphic Levels: 27
		
Cell Name: PSMHP Description: PROP. SEWER MH PROFILE Cell Type: Graphic Levels: 27	Cell Name: DETA Description: TIE IN DETAIL Cell Type: Graphic Levels: 2	Cell Name: DETB Description: HORIZ CROSSING WTR MAIN Cell Type: Graphic Levels: 2
		
Cell Name: RMHPL Description: REHAB. EX. MH PLAN Cell Type: Graphic Levels: 27	Cell Name: DELTA Description: DELTA FOR NOTES Cell Type: Graphic Levels: 2	Cell Name: PM Description: PLUS MINUS Cell Type: Graphic Levels: 2
		
Cell Name: CAP Description: COORDINATE CAPSULE Cell Type: Graphic Levels: 2	Cell Name: CC Description: CAUTION CALL OUT BLANK Cell Type: Graphic Levels: 2	Cell Name: CCCATV Description: CAUTION CALL OUT CATV Cell Type: Graphic Levels: 2

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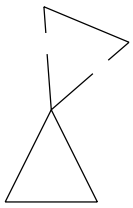
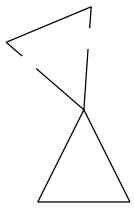
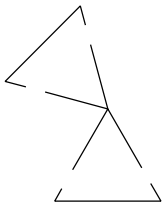
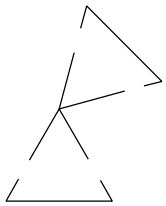
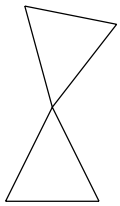
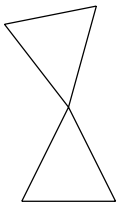
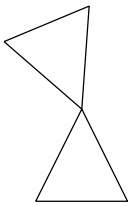
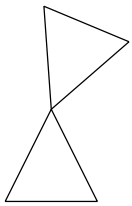
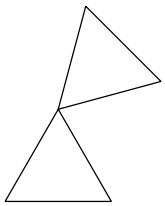
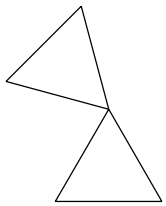
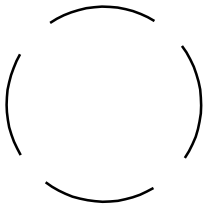
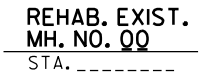
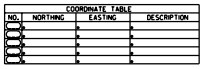
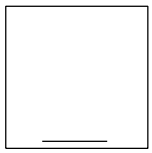
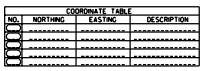
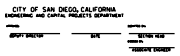
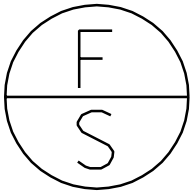
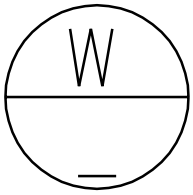
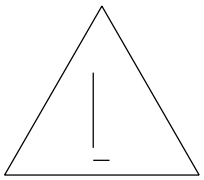
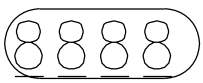
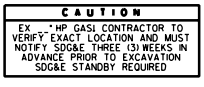
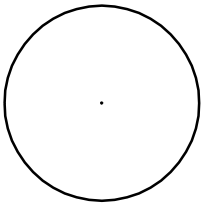
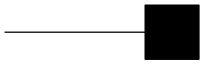
ELEC.	GAS	TEL.
Cell Name: CCEL Description: CAUTION CALL OUT ELEC Cell Type: Graphic Levels: 2	Cell Name: CCGAS Description: CAUTION CALL OUT GAS Cell Type: Graphic Levels: 2	Cell Name: CCTEL Description: CAUTION CALL OUT TEL Cell Type: Graphic Levels: 2
		
Cell Name: PDE22R Description: PROP. DASH. ELB. 22 RT Cell Type: Graphic Levels: 26	Cell Name: PDE22L Description: PROP. DASH. ELB. 22 LT Cell Type: Graphic Levels: 26	Cell Name: PDEIIR Description: PROP. DASH. ELB. II RT Cell Type: Graphic Levels: 26
		
Cell Name: PDEIIL Description: PROP. DASH. ELB. II LT Cell Type: Graphic Levels: 26	Cell Name: PDE45L Description: PROP. DASH. ELB. 45 LT Cell Type: Graphic Levels: 26	Cell Name: PDE45R Description: PROP. DASH. ELB. 45 RT Cell Type: Graphic Levels: 26
		
Cell Name: PELIIR Description: PROP. ELBOW II RT Cell Type: Graphic Levels: 26	Cell Name: PELIIL Description: PROP. ELBOW II LT Cell Type: Graphic Levels: 26	Cell Name: PEL22L Description: PROP. ELBOW 22 LT Cell Type: Graphic Levels: 26
		
Cell Name: PEL22R Description: PROP. ELBOW 22 RT Cell Type: Graphic Levels: 26	Cell Name: PEL45R Description: PROP. ELBOW 45 RT Cell Type: Graphic Levels: 26	Cell Name: PEL45L Description: PROP. ELBOW 45 LT Cell Type: Graphic Levels: 26

		
Cell Name: PW Description: PROP. WATER MAIN Cell Type: Graphic Levels: 26	Cell Name: PDMHPL Description: PROP. DASHED MH PLAN Cell Type: Graphic Levels: 27	Cell Name: RMHCAL Description: REHAB. EX. MH CALL OUT Cell Type: Graphic Levels: 29
		
Cell Name: PSMHLP Description: REHAB EXIST MH PROFILE Cell Type: Graphic Levels: 27	Cell Name: CTABI Description: COORDINATE TABLE Cell Type: Graphic Levels: 2	Cell Name: DT Description: DATA BOX 4 DATA TABLE Cell Type: Graphic Levels: 2
		
Cell Name: CTAB2 Description: COORD TABLE DATA FIELD Cell Type: Graphic Levels: 2	Cell Name: TMOD Description: TITLE BLOCK REV. Cell Type: Graphic Levels: 3,62	Cell Name: PFSER Description: PROP. FIRE SERVICE Cell Type: Graphic Levels: 26
		
Cell Name: PWSER Description: PROP. WATER SERVICE Cell Type: Graphic Levels: 26	Cell Name: ABSYM Description: ASBUILT SYMBOL Cell Type: Graphic Levels: 59	Cell Name: ABINF Description: AS BUILT TITLE INFO. Cell Type: Graphic Levels: 58,59
		
Cell Name: CAP4 Description: COORDINATE CAPSULE Cell Type: Graphic Levels: 2	Cell Name: CCGASI Description: ADV NOTICE CALL OUT Cell Type: Graphic Levels: 2	Cell Name: CCELI Description: ADV NOTICE CALL OUT Cell Type: Graphic Levels: 2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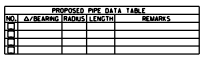	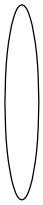	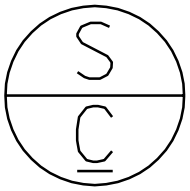
Cell Name: DTAB Description: DATA TABLE Cell Type: Graphic Levels: 2	Cell Name: PWI6PR Description: PWI6PR Cell Type: Graphic Levels: 26	Cell Name: PSLAT Description: PROP. SEWER LATERAL Cell Type: Graphic Levels: 27

Attachment 2-9
Cell Library: A&E Common Symbols and Graphic Scales
(cipae.cel)

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008	DET RT OPEN RT	1
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011	SECT TAIL RT LK UP	1
013	SECT RT LK UP OPEN RT	1
014	SECT RT LK UP DASH	1
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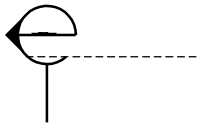		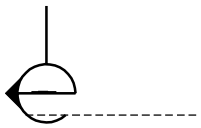
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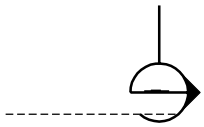	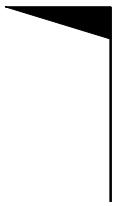	
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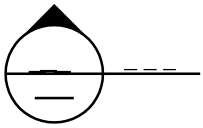
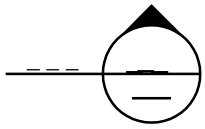
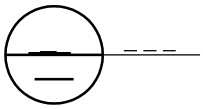
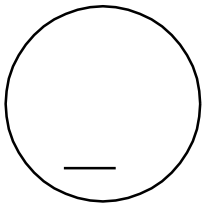
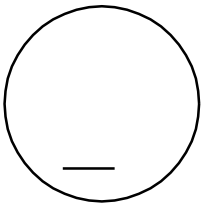
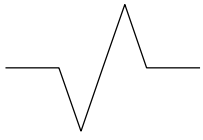
		
Cell Name: 010 Description: SECT LT LK UP DASH Cell Type: Graphic Levels: 3	Cell Name: 011 Description: SECT TAIL RT LK UP Cell Type: Graphic Levels: 3	Cell Name: 013 Description: SECT RT LK UP OPEN RT Cell Type: Graphic Levels: 3
		
Cell Name: 014 Description: SECT RT LK UP DASH Cell Type: Graphic Levels: 3	Cell Name: 015 Description: SECT TAIL LT LK UP Cell Type: Graphic Levels: 3	Cell Name: 020 Description: DET LT DASH Cell Type: Graphic Levels: 3
		
Cell Name: 021 Description: GRID BUBBLE X UP Cell Type: Graphic Levels: 11	Cell Name: 022 Description: GRID BUBBLE X LEFT Cell Type: Graphic Levels: 11	Cell Name: 023 Description: BREAKLINE HORIZ Cell Type: Graphic Levels: 1

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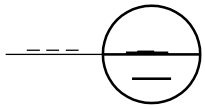
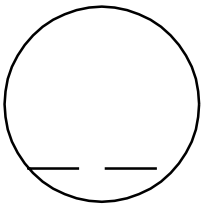
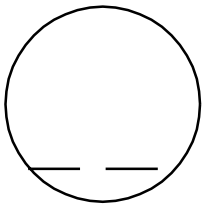
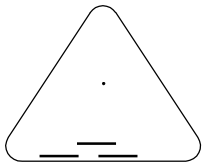
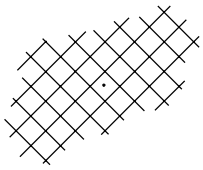
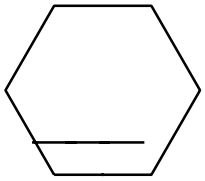
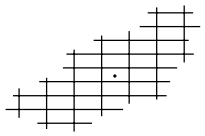
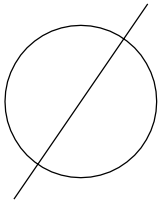
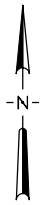
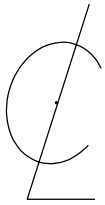
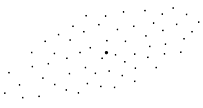
		
Cell Name: 024 Description: DET RT DASH Cell Type: Graphic Levels: 3	Cell Name: 025 Description: GRID BUBBLE XX UP Cell Type: Graphic Levels: 11	Cell Name: 026 Description: GRID BUBBLE XX LEFT Cell Type: Graphic Levels: 11
		
Cell Name: 027 Description: REVISION DELTA Cell Type: Graphic Levels: 58	Cell Name: 028 Description: CHKD PL SYMBOL INT Cell Type: Graphic Levels: 13	Cell Name: 031 Description: HEX GRID BUBBLE Cell Type: Graphic Levels: 11
		
Cell Name: 032 Description: GRATING SYMBOL INT Cell Type: Graphic Levels: 13	Cell Name: 033 Description: DIAMETER SYMBOL Cell Type: Graphic Levels: 2	Cell Name: 034 Description: CIVIL TRUE NORTH Cell Type: Graphic Levels: 59
		
Cell Name: 035 Description: TRUE NORTH FOR KEY Cell Type: Graphic Levels: 59	Cell Name: 036 Description: EARTH SYMBOL INT Cell Type: Graphic Levels: 13	Cell Name: 037 Description: CENTERLINE SYMBOL Cell Type: Graphic Levels: 2
		
Cell Name: 038 Description: LARGE NORTH ARROW UP Cell Type: Graphic Levels: 59	Cell Name: 040 Description: SAND SYMBOL INT Cell Type: Graphic Levels: 13	Cell Name: 041 Description: ARROWHEAD NORMAL CELL Cell Type: Graphic Levels: 2

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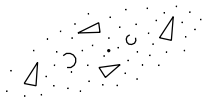
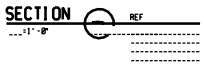
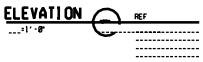
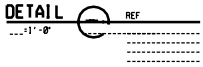
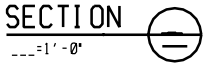
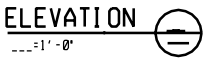
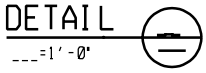
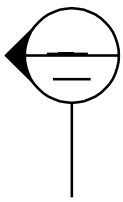
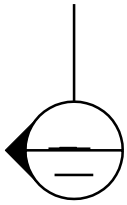
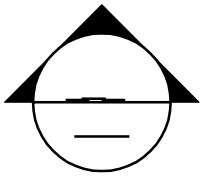
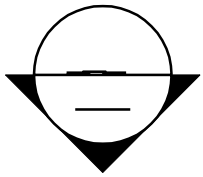
		
Cell Name: 042 Description: LARGE NORTH ARROW LT Cell Type: Graphic Levels: 59	Cell Name: 044 Description: CONCRETE SYMBOL INT Cell Type: Graphic Levels: 13	Cell Name: 045 Description: SECT TITLE OPEN RT Cell Type: Graphic Levels: 3
		
Cell Name: 046 Description: ELEV TITLE OPEN RT Cell Type: Graphic Levels: 3	Cell Name: 047 Description: DET TITLE OPEN RT Cell Type: Graphic Levels: 3	Cell Name: 048 Description: SECT TITLE DASH Cell Type: Graphic Levels: 3
		
Cell Name: 049 Description: ELEV TITLE DASH Cell Type: Graphic Levels: 3	Cell Name: 050 Description: DET TITLE DASH Cell Type: Graphic Levels: 3	Cell Name: 055 Description: SECT RT LK DN OPEN RT Cell Type: Graphic Levels: 3
		
Cell Name: 056 Description: SECT UP LK LT DASH Cell Type: Graphic Levels: 3	Cell Name: 058 Description: SECT DN LK LT DASH Cell Type: Graphic Levels: 3	Cell Name: 060 Description: SECT LT LK UP OPEN LT Cell Type: Graphic Levels: 3
		
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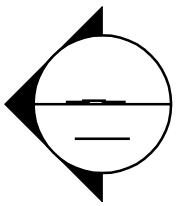
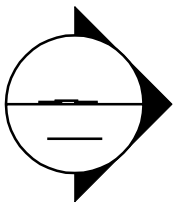
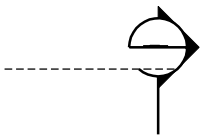
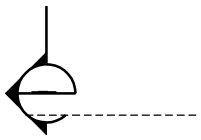
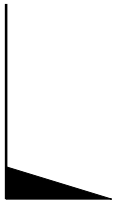
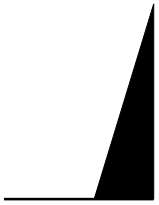
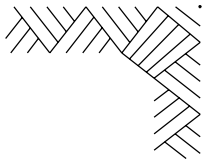
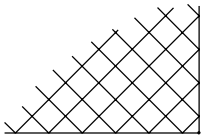
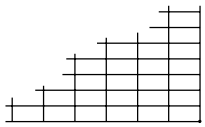
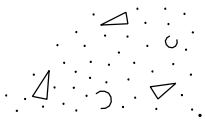
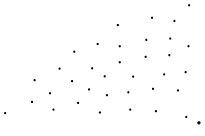
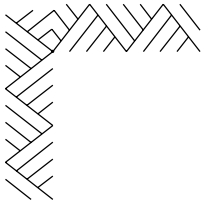
		
Cell Name: 068 Description: ELEV LT DASH Cell Type: Graphic Levels: 3	Cell Name: 069 Description: ELEV RT DASH Cell Type: Graphic Levels: 3	Cell Name: 072 Description: ELEV LT LK UP OPEN LT Cell Type: Graphic Levels: 3
		
Cell Name: 074 Description: ELEV LT LK DN OPEN LT Cell Type: Graphic Levels: 3	Cell Name: 077 Description: ELEV UP LK RT OPEN LT Cell Type: Graphic Levels: 3	Cell Name: 078 Description: ELEV DN LK LT OPEN RT Cell Type: Graphic Levels: 3
		
Cell Name: 082 Description: SECT TAIL DN LK RT Cell Type: Graphic Levels: 3	Cell Name: 083 Description: SHORT TAIL RT LK UP Cell Type: Graphic Levels: 3	Cell Name: 084 Description: SHORT TAIL DN LK LT Cell Type: Graphic Levels: 3
		
Cell Name: 085 Description: EARTH SYMBOL CORNER Cell Type: Graphic Levels: 13	Cell Name: 086 Description: CHKD PL SYMBOL CORNER Cell Type: Graphic Levels: 13	Cell Name: 087 Description: GRATING SYMBOL CORNER Cell Type: Graphic Levels: 13
		
Cell Name: 088 Description: CONCRETE SYMBOL CORNER Cell Type: Graphic Levels: 13	Cell Name: 089 Description: SAND SYMBOL CORNER Cell Type: Graphic Levels: 13	Cell Name: 090 Description: EARTH SYMBOL INT COR Cell Type: Graphic Levels: 13

WATER DEPARTMENT

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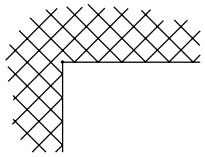
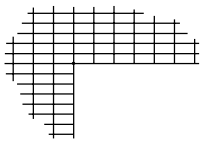
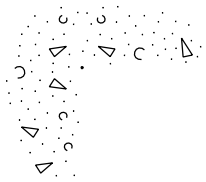
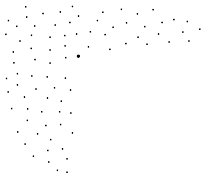
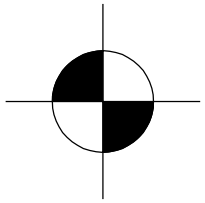
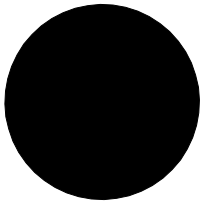
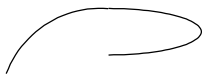
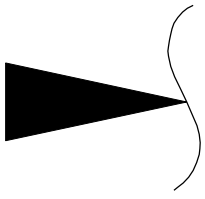
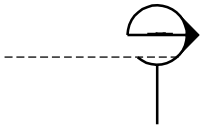
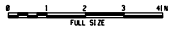
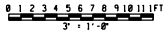
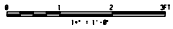
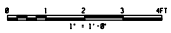
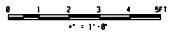
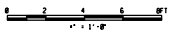
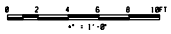
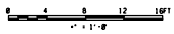
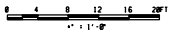
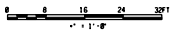
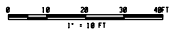
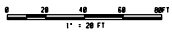
		
Cell Name: 091 Description: CHKD PL SYMBOL INT COR Cell Type: Graphic Levels: 13	Cell Name: 092 Description: GRATING SYMBOL INT COR Cell Type: Graphic Levels: 13	Cell Name: 093 Description: CONC SYMBOL INT COR Cell Type: Graphic Levels: 13
		
Cell Name: 094 Description: SAND SYMBOL INT COR Cell Type: Graphic Levels: 13	Cell Name: 095 Description: TYP TAIL LT Cell Type: Graphic Levels: 3	Cell Name: 096 Description: SIM TAIL LT Cell Type: Graphic Levels: 3
		
Cell Name: 098 Description: TARGET OR WP 5_32 IN Cell Type: Graphic Levels: 2	Cell Name: LOOP Description: LOOP TERM Cell Type: Point Levels: 2	Cell Name: LT2 Description: ARROWHEAD TERM Cell Type: Point Levels: 2
		
Cell Name: LT3 Description: WORM TERM Cell Type: Point Levels: 2	Cell Name: LT4 Description: DOT TERM Cell Type: Point Levels: 2	Cell Name: LT5 Description: PART LOOP TERM Cell Type: Point Levels: 2
		
Cell Name: LT6 Description: AH AND WORM TERM Cell Type: Point Levels: 2	Cell Name: 002 Description: SECT UP LK RT OPEN LT Cell Type: Graphic Levels: 3,59	Cell Name: GS1 Description: FULL SIZE ENGR Cell Type: Graphic Levels: 59

		
Cell Name: GS2 Description: HALF SIZE ENGR Cell Type: Graphic Levels: 59	Cell Name: GS4 Description: 3IN TO 1FT ARCH Cell Type: Graphic Levels: 59	Cell Name: GS8 Description: 1 1_2IN TO 1FT ARCH Cell Type: Graphic Levels: 59
		
Cell Name: GS12 Description: 1IN TO 1FT ENGR Cell Type: Graphic Levels: 59	Cell Name: GS16 Description: 3_4IN TO 1FT ARCH Cell Type: Graphic Levels: 59	Cell Name: GS24 Description: 1_2IN TO 1FT ARCH Cell Type: Graphic Levels: 59
		
Cell Name: GS32 Description: 3_8IN TO 1FT ARCH Cell Type: Graphic Levels: 59	Cell Name: GS48 Description: 1_4IN TO 1FT ARCH Cell Type: Graphic Levels: 59	Cell Name: GS64 Description: 3_16IN TO 1FT ARCH Cell Type: Graphic Levels: 59
		
Cell Name: GS96 Description: 1_8IN TO 1FT ARCH Cell Type: Graphic Levels: 59	Cell Name: GS120 Description: 1IN TO 10FT ENGR Cell Type: Graphic Levels: 59	Cell Name: GS240 Description: 1IN TO 20FT ENGR Cell Type: Graphic Levels: 59
		
Cell Name: GS480 Description: 1IN TO 40FT ENGR Cell Type: Graphic Levels: 59	Cell Name: GS1200 Description: 1IN TO 100FT ENGR Cell Type: Graphic Levels: 59	Cell Name: GS2400 Description: 1IN TO 200FT ENGR Cell Type: Graphic Levels: 59

WATER DEPARTMENT

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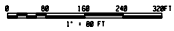
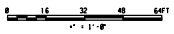


Cell Name: GS960
Description: 1IN TO 80FT ENGR
Cell Type: Graphic
Levels: 59

Cell Name: GS4800
Description: 1IN TO 400FT ENGR
Cell Type: Graphic
Levels: 59

Cell Name: GS12K
Description: 1IN TO 1000FT ENGR
Cell Type: Graphic
Levels: 59



Cell Name: GS192
Description: 1_16IN TO 1FT ARCH
Cell Type: Graphic
Levels: 59

Attachment 2-10
Cell Library Log/Cell Design Log

CELL LIBRARY LOG

WATER DEPARTMENT
City of San Diego

File Name ______________________________

Description ______________________________

Directory ______________________________

Project Name / No. ______________________________

Project Engineer ______________________________ Log Originator ______________________________

Cell Name	Cell Description	Placement		
		Scale	Angle	Rel/Abs

CELL DESIGN LOG

WATER DEPARTMENT
City of San Diego

Cell Name _____
Cell Library _____

Design Information							
Type Regular Point Menu	Level	Color	Line Weight	Line Code	Patterning	Text Font	Nested Cells Yes No

Placement Information			
Design File Working Units	Scale	Angle	Level Rel / Abs

Cell Graphics (Indicate cell origin)

Originated By: Date:

Attachment 2-11
CADD File Transmittal Form

CADD FILE TRANSMITTAL

WATER DEPARTMENT
City of San Diego

Consultant	Date	Document Control #
Site	Contract	Task
Media Type and Count		
Directory Structure for File Retrieval		

In the space below, list each file with its full directory path, drawing number, transmittal status (preliminary, final, revised) and the size of the plot transmitted (if any).

Attach a computer printout to this form showing the file name, size in bytes or blocks and the date last modified for each file.

File Name	Drawing Number	Status	Plot Size

Originated By:	Date:

Attachment 2-12
CADD File Acceptance Form

CADD FILE ACCEPTANCE

WATER DEPARTMENT
City of San Diego

Consultant	Date	Document Control #
Site	Contract	Task
Media Type and Count		

Acceptance Checklist

___ Verify media type, count, and proper ,media labels.

___ Compare list of files on transmittal form to required computer printout. Make sure that plots are attached as indicated.

___ Retrieve files from media.

___ For each file, compare the name, size, and date last modifies to the computer printout.

___ Bring each file up on a graphics terminal to verify that view one contains the title block and view five contains the overview.

___ Verify each file with the EDG utility.

___ Plot each file.

___ Compare each plot to transmitted sheets.

Note any problems or exceptions

Verified By:	Date:

Book 5

CADD Standards

Chapter 3
General Drafting Standards

City of San Diego Water Department
Capital Improvements Program

Chapter 3
GENERAL DRAFTING STANDARDS

3.1 Introduction

These drafting standards were developed for the Water CIP to:

- Enhance the level of graphic consistency.
- Provide guidelines for preparing design documents, especially drafting notations, symbology and abbreviations.
- Establish a level of uniformity.
- Supply information to the DESIGN CONSULTANT relating to the drafting methods and materials for the program.

This manual is not a design textbook, nor does it substitute for professional experience. Furthermore, this manual does not address procedural issues or organizational responsibilities. It primarily addresses graphic issues and establishes guidelines and drafting standards for the production of design drawings.

Sections 3.2 and 3.3 of this chapter describe the symbology and abbreviations for all the disciplines expected to be used on all design projects under the Water CIP. Section 3.4 describes the various classifications of drawings and what is expected in each drawing. Sections 3.5 through 3.17 give guidelines for the choice of scale, type of lettering, thickness or pen, direction of the north arrow and selection of key map. Section 3.18 describes the numbering systems to be used on drawings for equipment, piping and instrumentation. The sequence of drawings is discussed in Section 3.19. Section 3.20 gives rules regarding reproduction. Section 3.21 elaborates on discipline specific aspects not covered in the more general sections.

All figures are presented in sequential order at the end of this chapter.

3.2 Symbology

The preparation of clear and unambiguous drawings requires strict adherence to a standard nomenclature. A system of standard symbols for component identification also makes coordination and communication between design disciplines and construction trade groups more effective.

The symbols to be used are those established by the American National Standards Institute (ANSI), the Instrument Society of America (ISA) and other nationally-recognized organizations.

3.3 Abbreviations

The Water CIP does not encourage reliance on abbreviations to convey information on drawings. However, space limitations mandate use of abbreviations in certain situations. Abbreviations used in the Water CIP conform to ANSI as much as possible. A comprehensive list of standard abbreviations used by the City is presented in Figure 3-1.

Abbreviations must be used carefully. Important rules are:

- Avoid abbreviations with more than one common meaning.
- An abbreviation used on one drawing must have the same meaning on all the drawings.
- A word abbreviated once on a drawing must be abbreviated everywhere on the drawing.
- Use abbreviations only to avoid excessive clutter or busyness on drawings.

3.4 Classification of Drawings

Drawings are classified by the purpose they serve in the design and construction process.

3.4.1 Progress Submittals

Progress submittals are made to the CIP Project Manager (PM) at 30, 75 and 90% completion of design as described in Chapter 6 of Book 1. Drawings may be classified by the degree of completion represented by the submittal. The appropriate degree of drawing completion for each submittal is defined in Book 1, General Design Guidelines, Chapter 6, Design Development.

3.4.2 Camera Ready Drawings

These are the final, complete drawings, ready to print and bind in one or more volumes for prospective bidders.

3.4.3 Addendum Drawings

Addendum drawings are issued by a formal process between the advertisement and bid opening. Addendum drawings may change, add or remove some of the work of the previously issued drawings.

3.4.4 Construction Drawings

When the contract is awarded, addendum drawings are incorporated onto the camera ready drawings to form the construction drawings.

3.4.5 Supplemental Drawings

Supplemental drawings are issued after contract award to explain or clarify a construction drawing. These drawings do not affect cost or schedule and are not a part of the construction drawings.

3.4.6 Change Order Drawings

Change order drawings cover changes made during construction. These drawings become part of the construction drawings after the change order is signed by the City and the Construction Contractor.

3.4.7 As-Built Drawings

These drawings are markups prepared by the Construction Contractor on copies of the construction drawings to show how the actual facility departs from the construction drawings. This information must be transferred to the CADD file. The as-built drawings must be delivered within 60 days after final substantial completion of construction date. Procedures for as-built drawings are described in Book 1, General Design Guidelines, Chapter 21, Records Management and Document Control.

3.5 Drawing Materials

Four-mil mylar is used for all drawings. Drawings submitted on mylar must be prepared with ink, suitable plastic pencil or electrostatic toner.

The entire drawing should be prepared on the upper side of the sheet. Placing certain portions on the under side of the sheet is not acceptable.

If stick-on material is placed on a drawing, a photographically produced single-sheet mylar copy, which permits high quality prints and microfilm, must be prepared for submittal to the City. The City does not accept drawings with stick-on material. Mylar drawings with stick-on materials, scuff marks, creases, marks on the back or indentations are not accepted by the City.

3.6 Size

Drawings are prepared in accordance with ANSI Standard Y14.1-1995. ANSI standard sheet sizes are shown in Table 3-1.

D-sized sheets are required for camera ready drawings and are also appropriate for some addendum drawings. Other addendum drawings are better shown on A-sized sheets. Change order and other drawings prepared during construction may use A, B, or D sheets. All changes are made in the electronic CADD files.

Table 3-1
ANSI Standard Drawing Sheet Sizes

ANSI	Size (Inches)		Margin (Inches)	
Designation	Width	Length	Width	Length
A	8.5	11.0	0.25	.038
B	11.0	17.0	0.38	.062
C	17.0	22.0	0.75	.050
D	22.0	34.0	0.50	1.00
E	34.0	44.0	1.00	0.5

3.7 Standard Borders

All D-sized drawings must be on the standard border. A blank sample CIP border is shown in Figure 3-2, sheet 1. The CIP border serves several purposes:

- Identifies the drawing with the Water CIP.
- Provides information used by the City to archive drawings.
- Identifies the DESIGN CONSULTANT and staff responsible for preparing the drawing.
- Provides other basic information (title, scale, revisions, etc.) in a consistent location and format for use in the City document management system.

Sheet 2 of Figure 3-2 describes the title block areas of a typical CIP border.

3.8 Use of Wash-off Mylar

The use of wash-off mylar is acceptable when an existing drawing or a major portion of such a drawing can be used as a base for a new drawing with minor alterations.

It cannot be overemphasized that wash-off mylars must be clean and streak-free so they may be used to generate reproducible mylars and may be adequately microfilmed.

Lettering on wash-off mylar must be clear and legible with line quality suitable for reproduction. The minimum line width should be 0.015 inch.

3.9 Drafting Practices

Each drawing prepared for the Water CIP must be uncluttered, legible and easy to understand. Drawings must have a high degree of uniformity. This section presents scaling, lettering, lining, notation and dimensioning techniques and practices that all disciplines must follow.

General guidelines are:

- Eliminate Repetitive Details: When several items have common details, show the common detail once.

- Eliminate Unnecessary Lines: Only those lines necessary to convey the design should be used. For example, closely spaced parallel lines to depict curbs are superfluous; one heavy solid line should suffice.

- Use Abbreviations Sparingly: Abbreviations may be used only where they are required to save space. Abbreviations must be clear and easily understood.

- Use Symbols Frequently: Symbols reduce drafting time, increase legibility and conserve space.

- Use Tabulations Appropriately: Tables consolidate related data into one location which normally might be scattered in many locations.

3.10 Scale

As a general rule, use the smallest possible scale to show a view without obscuring vital details. Scales must be selected with the following requirements in mind:

- Maintain clarity when notes and dimensions are added to drawings.
- Maintain legibility when drawings are reduced to half size.
- Maintain readability when files are microfilmed for archival purposes.

The scales listed in Table 3-2 are recommended; however, they may be varied to accommodate the need of a particular drawing. The use of distorted scales (different horizontal and vertical scales) is acceptable for pipeline profile drawings.

The rules listed below should be followed to show the scale of a drawing:

- When multiple views on a drawing are not to the same scale, the appropriate scale should be centered 1/8-inch below the title of each view. The title block scale should read "as shown."

- When the entire drawing is to the same scale, the scale should be listed in the title block.

- When an entire drawing (such as a diagram, a schematic or an isometric drawing) is not to scale, "No Scale" should be noted in the title block. If only one view on the drawing is not to scale, the notation "No Scale" should be placed below the view in question.

- The notation "NTS" (not to scale) should only be used for specific dimensions within a drawing that are not to scale.

- For plan and profile drawings, the vertical and horizontal scales should have a 1:10 ratio. That is, if the vertical scale is 1 inch = 4 feet, then the horizontal scale should be 1 inch = 40 feet. Similarly, a 1 inch = 10 feet vertical scale corresponds to a 1 inch = 100 feet horizontal scale.

Table 3-2
Typical Drawing Scales, All Disciplines

Scale	Drawing Type
1 inch = 100 feet 1 inch = 80 feet 1 inch = 40 feet 1 inch = 20 feet 1 inch = 10 feet 1 inch = 200 feet 1 inch = 400 feet 1 inch = 1000 feet	General Plan Views, Site Civil, Civil Sections, Yard Piping, etc.
1 inch = 4 feet, vertical and 1 inch = 40 feet, horizontal or 1 inch = 10 feet, vertical and 1 inch = 100 feet, horizontal	Profile Views
1/6 inch = 1 foot 1/8 inch = 1 foot 3/16 inch = 1 foot 1/4 inch = 1 foot 3/8 inch = 1 foot 1/2 inch = 1 foot 3/4 inch = 1 foot 1 inch = 1 foot	Sections, Details, A&E Plans
1-1/2 inch = 1 foot 3 inches = 1 foot	Enlarged Sections, Details

3.11 Lettering

Most drawings for the Water CIP are to be prepared using a CADD system. MicroStation Font 1 is the basic text font for the Water CIP. Other fonts may be used in certain situations as described in Chapter 2, subject “Fonts.” The following information is provided to assist in preparing the few drawings that may be drawn manually.

Drawings should use simple letters and figures without embellishments. Lettering should be Gothic style, vertical capitals. Slant lettering is not acceptable. For illustrations of Gothic styles, refer to the ANSI Standard Y14.2M-1992, Figures 16 and 17.

The following are general guidelines for lettering.

3.11.1 Size

Lettering on full size D sheets should never be less than 1/8-inch in height. Table 3-3 presents Leroy Templates and pen sizes to be used at several locations on drawings. Figure 3-3 shows examples.

Table 3-3
Mechanical Lettering Size

Purpose	Leroy Template	Pen
Cover Sheet		
Name of Project	750	6
Drawing Number	200	2
CIP Number, etc.	175	2
Cover Sheet Notes	140	1
Title Block Information		
Project Name	140	1
Drawing Title	200	1
All Other Information	140	1
City AD@ Number (Lower Right)	200	1
Scale Identification (View)	140	2
Column Line Balloons (Arch & Struct)	175	2
Main Titles		
Drawing Body	175	2
Key Plan	140	1
Subtitles	140	1
Section and Detail Callouts	140	1
Drawing Text	120	0

3.11.2 Mechanical Lettering (Leroy)

Mechanical lettering style should be vertical Leroy with appropriate Leroy pen sizes and letter heights as shown in Table 3-3 and Figure 3-3.

Leroy lettering should be used for title blocks, view titles, scale identification, column lines and section and detail balloons. Higgins Black Magic and Koh-I-Noor ink are acceptable.

3.11.3 Freehand Lettering

Freehand lettering is acceptable as long as it matches the style and size required of mechanical lettering. Either ink or suitable plastic pencil is acceptable. A lettering guide or preprinted underlay should be used to ensure straight lines and uniform letter sizes.

3.11.4 Typewritten Lettering

Typewritten lettering is appropriate for general notes on title sheets. Typewritten lettering may be done using either of the following methods:

- Typing directly on the drawing using specially modified typewriters with open-ended carriages.
- Typing onto transfer film (sticky-back) using a regular typewriter and applying the film to the drawing. The drawing must then be photographically reproduced to create a new plan sheet before it is submitted to the Water CIP at the end of design. Transfer film is not acceptable on submittals.

3.11.5 Kroy Lettering

The Kroy machine places black characters on transparent transfer tape which is not acceptable on drawings unless the drawing is photographically reproduced for submittal to the CIP at the end of design.

3.11.6 Reading Direction

Normally, all letters and figures should be readable from either the bottom or right edge of the sheet. The guide for reading is as follows:

- Horizontal lettering should read from left to right.
- Vertical lettering should read from bottom to top.
- Diagonals should read from left to right, bottom to top up to 120E, top to bottom above 120E (see Figure 3-4 for detail).

3.11.7 Other Guidelines

- All lettering should be upper case.
- Fractions should be written horizontally and have slanted midlines (1/2, 1-1/2).
- The number 1 should have a base to avoid confusion with the letter I.

3.12 Line Work

DESIGN CONSULTANTS must keep in mind that the ultimate products of their work are the prints made from their drawings and not the drawings themselves. Lines and lettering must be of adequate size and weight to produce legible half-size reproductions. Lines should be sufficiently thick to print well and make readable photocopies. Line work must be smooth, black, firm, equally spaced, of uniform weight and density throughout the drawings, and ends should be clearly defined. Line work should adhere to the following guidelines (see Figure 3-5 for detail of the line pattern and width):

3.12.1 Line Widths

Line widths should vary to distinguish certain features as follows:

1. Extra heavy lines (Pen #3/MicroStation line weight 4) should be used for main process lines on schematics.

2. Heavy lines (Pen #2/MicroStation line weight 3) should be used for emphasis for basic outlining features of new facilities. Examples are baseline, construction layout lines, and the outline of objects. Heavy lines should also be used on secondary process lines on schematics, double-line piping, flange outlines and on cutting plane lines.

3. Medium weight lines (Pen #1/MicroStation line weight 2) should be used for proposed construction and right-of-way, match lines, single-line drawings, flanges and equipment.

4. Fine lines (Pen #00/MicroStation line weight 1) should be used for topography, outline of existing and future facilities and other less important details.

5. Extra fine lines (Pen #000/MicroStation line weight 0) should be used for centerlines, phantom lines, column lines (see Figure 3-6), dimension lines, leader lines and hidden lines for new and existing facilities.

6. Dashed lines should be used for hidden lines and also to distinguish existing from proposed work.

3.12.2 Line Spacing

Line spacings should be at least 0.06-inch to avoid closed-up or blocked-in spaces on microfilm. In MicroStation, the line spacing is one-half the text height.

3.12.3 Line Patterns

Line patterns should be selected from the eight basic ones:

1. Solid
2. Dotted
3. Long Dash
4. Medium Dash
5. Short Dash
6. Dash Dot
7. Dash Dot Dot
8. Long Dash Short Dash

3.12.4 Line Usage

1. Centerline and column lines should extend 1/4-inch beyond a view, or farther if necessary, for indicating dimensions. Do not extend them into the space

between views or continue them from one view to the next. End column lines with column-line balloons (3/8 inch-diameter circles).

2. In general, if an object has dimensions which are too long to be shown at the scale being used, the object should be broken and the dimensions indicated across the break. Scattering of dimensions across the sheet should be avoided if at all possible.

   The overall dimension and string dimensions should be located far enough away from the object drawing to ensure uniformity and clarity, in addition to providing space for future notations.

   Where several closely spaced parallel lines occur (i.e., pavements, shoulders, curbs, medians), place dimensions between the parallel lines without using arrows. Enlarged details should be used where dimensioning is congested or crowded.

3. Leader or callout lines are usually drawn at an angle of 30E to 60E whenever possible, with an arrowhead at the drawing feature being annotated and no terminator at the note.

   Leader lines should start at the note with a short line (1/8-inch minimum) parallel to the note's base. Leader lines are then angled before terminating at the appropriate feature with a line terminator. When the note is to the right of the object, the leader line should start with the first word of the note. When the note is to the left of the object, the leader line should start with the last word of the note. Leader lines in the same area should be parallel. Avoid leader lines that are:

   - Horizontal or vertical
   - At the same angle as cross-hatching
   - At very small angles to the terminating surface
   - Parallel to extension or dimension lines
   - Curved
   - Crossed
   - Too long

4. Cutting-plane lines should extend beyond the view and end with horizontally bisected circles (1/2-inch diameter on one end and arrowhead at the other end of the cutting-plane line).

3.12.5 Line Terminations

Line terminators are used on dimension lines, leader lines and cutting-plane lines. The type of line terminator used depends on the feature to be emphasized and on available space. Line terminators may be one of the following:

- Arrowheads are used to terminate dimension and leader lines. If a dimension is required inside a space less than 3/8-inch, external dimension lines and arrowheads may be used (see Figure 3-7).

- Slashes are used to terminate dimension lines inside a space less than 3/8-inch. Slashes are approximately 1/8-inch long.

- Loops are used to terminate leader lines at reinforcing steel bars, electrical wires, piping, and schematic lines. Their approximate radius is 1/16-inch, and they start and stop one radius from the line identified.

3.13 Views

Usually, a drawing requires at least two views to adequately describe an area. Complex areas may need several views, including auxiliary views and sections. Some simple areas may require only one view wherein the specification will adequately describe the rest of it.

Views should be oriented within the format so as not to crowd each other, the border or other data. The placement of auxiliary views should be in proper relation to main views and be complete enough only to explain the detail which made the view necessary. Break lines, tabular identities of similar items and short word descriptions are permissible as long as clarity is not impaired. These guidelines should be followed in placing the views:

- The main plan view should be placed in the drawing's upper left corner. If there is more than one plan view, views should be arranged at the top of the drawing in sequence from left to right.

- Sections, details, elevations and schematics (in that order) should be placed directly below the main plan view when space is available; otherwise they should be placed to the right. Sections and details should be displayed in sequential order, always moving from left to right. Whenever possible, views that relate to one another should be grouped on the same drawing.

- View notes should be located 1/4-inch between the lettering and the drawing and should be left-justified.

- Allow 4 to 6 inches between views to insert notes and dimensions, and 2-1/2 inches at the borders.

3.14 Callouts

This section describes the formats and layout guidelines for callouts on the drawings.

3.14.1 Sections and Details

If possible, sections and details should be on the same drawing where called out. When shown on a different drawing, place section views to the right of plan views. If a drawing shows only sections and details, sections take precedence, and are shown in sequential order from the drawing's top left corner.

When showing a section cut through a plan, refer to Figure 3-8 for the proper arrowheads to show the direction of the cut, the bubble identifying the section letter and the number of the drawing where the section is located.

Figure 3-9 shows a detail callout. The standards for pen size and thickness of arrow should be followed.

Figure 3-10 shows standard detail callouts for both program and City standard details.

3.14.2 Equipment and Piping

Equipment and piping callouts should follow Figure 3-11. Equipment and pipe callouts are placed in differently shaped blocks. Criteria for drawing pipes as single or double lines are shown in Table 3-4.

Table 3-4
Criteria for Showing Pipe as Single or Double Line

Pipe Diameter, In.	Drawing Scale			
	1/8	1/4	3/8	1/2
2	S	S	S	S
3	S	S	S	O
4	S	S	O	D
5	S	S	D	D
6	S	O	D	D
8	S	D	D	D
10	S	D	D	D
12	O	D	D	D
14 and larger	D	D	D	D

Note: S = Single line
O = DESIGN CONSULTANT Choice
D = Double Line

3.15 Notes

Two types of notes can appear on drawings: general notes which apply to all drawings, and view notes which apply to specific features on a specific drawing. The following sections explain the difference.

3.15.1 General Notes

General notes convey information common to the components of an entire drawing, process area, or discipline, or to all the drawings in a package. General notes are presented either on the drawing to which they apply, or to Drawing G-4 titled "General and Project Notes."

General notes should be placed in a column on the right side of a drawing with single-space lines within each note (1/16-inch apart) and double-space (1/4-inch) between notes. The general note column should be no wider than 5-3/4 inches plus a 1/4-inch margin between the notes and the drawing border, and should be left-justified. See Figure 3-12 for note location information.

3.15.2 View Notes

View notes (also known as local notes) show information pertaining to specific drawing features. Lines within each note should be single-spaced, and notes should be separated vertically at least one and one half spaces. One-quarter inch should separate the note and the drawing border horizontally. Notes should be left-justified.

View notes should be separated horizontally by at least 1/2-inch. Numbers should be the same height as the letters. See Figure 3-13 for further detail.

3.16 Seals/Signatures

Camera ready drawings, when issued for bidding, require the stamp of a California registered professional engineer or architect, his or her signature, and the date below the seal. This is normally the responsibility of the drawing approver. Revisions to drawings that have been stamped by a registered professional engineer or architect must be initialed and dated below the stamp or in the revision block column designated for initials by the same engineer who signed the original work. If this cannot be done, another registered professional engineer or architect can affix his seal to the drawings (or enter his registration number), and enter his signature and the date, noting that his seal covers only the specific revision. All seals must include the license expiration date.

3.17 Other Conventions

3.17.1 North Orientation

General plans such as maps and site plans must always include a north arrow. The project north orientation may be used to show the buildings and other structures squarely on the drawing sheet. In such drawings, the relationship between true north and project north must be as shown in Figure 3-14. The north arrow may point in any direction within plus or minus 90° of vertical.

The same orientation should be maintained for all plans in a series of similar sheets, regardless of discipline. If a plan view does not fit vertically on a drawing sheet, it can be rotated counterclockwise by as much as 90°. If the same orientation is not possible for certain plans within a set, place the note "Plan Orientation Different from Plant Layout" 1/4-inch below the north arrow.

On plan and profile sheets where the lowest elevation of the water main is shown at the left side of each sheet, stationing is from left to right, and the water main is constructed from left to right, the north arrow orientation cannot follow the convention described above for other sheets. The north arrow must be oriented in the direction dictated by the water main layout on the page.

The north arrow is located in the upper left corner of all plans, except plan and profile sheets, where it is near the title block in the lower right corner.

3.17.2 Key Plan

A key plan is a small scale layout of the overall site showing by cross-hatching the context of a drawing of a small portion of the site which otherwise might be difficult to identify. Key plans are placed in the lower right corner of a drawing. Key plans must be no larger than 4 inches square plus a 1-inch margin on all sides.

3.17.3 Scales

The standard border provides a block for scale information which applies to the entire sheet. It also provides a 1-inch bar to warn that a drawing may not be at its original full-size scale.

3.17.4 Unnecessary Information

Do not repeat dimensions except as necessary to relate one drawing or view clearly to another and only if there is no other way to identify location or orientation.

Do not repeat room names or numbers, door or window numbers or material identification. Show these on a larger scale detail or plan.

Do not render elevations, show shadows, or draw all the bricks, shingles or siding. A small area of texture or hatching at corners or a simple detail showing pattern and direction tells everything necessary. Cross hatching need not cover an entire wall or area in plan.

Do not draw interior elevations in which walls are blank.

Do not detail casework except for very unusual features. Draw elevations only and call out dimensions when necessary.

Do not use the term "By Others." Use "By Owner" or "NIC," meaning "Not In Contract."

3.17.5 General Drawing Information

Use multiple partial plans with match lines on projects if complexity demands it.

Provide only the kinds of information which relate clearly to the specifications. Designate items by generic names, not trade names, i.e., Gypsum Board, not Sheetrock.

Call out specific details of materials such as hardwood species, aluminum finish, or gypsum only when they cannot be clearly identified or described in schedules and specifications.

The accuracy of elements within a CADD drawing file depends on the use of proper drawing techniques and on the working units used in creating the file. There is a misconception that if a drawing is created digitally, it is precise and accurate. In fact, there are varying levels of accuracy. Because of the obvious legal implications involved in the accuracy of the Contract Documents, the accuracy requirements (both legal and contractual) for each project must be understood and followed by each project team member. Additionally, the Water CIP intends to

use these drawings as a component of its geographical informational system (GIS). The layering structure and attention to procedures is therefore important in that regard as well.

3.17.6 Drawing Changes

Changes made to drawings during design do not lead to any revision notations on the border. The drawing status block on the border is for formal changes made by addendum during the bid phase, change orders made during construction, and for recording as-built information.

A change is noted by describing it in the revision block, clouding the revised area on the drawing, and placing the revision letter or number in a triangle inside the clouded area. When the next revision is made to the drawing, the cloud is removed and the letter is kept.

3.17.7 Centerline Coordinates - Station and Elevation

In conformance with industry and local standards, buried pipelines are dimensioned on the Contract Drawings using stationing and invert elevations. Recognizing that this dimensioning system is not precise when slopes and horizontal bends are combined, the pipe fabricator must convert the invert data to a pipe centerline station and elevation coordinate system. For this purpose, the following definitions are used:

- The horizontal location of the intersection of the pipe centerlines at bends is defined as equal to that of the corresponding invert lines on the plan view.

- The vertical elevation of the intersection of the pipe centerlines at bends is defined as equal to the invert elevation at intersection of the invert lines plus the pipe inside radius.

Further recognizing that this conversion can have a minor effect upon final as-built pipe invert elevations, the pipe fabricator must provide precise invert elevations and pipe slopes for setting each pipe section and fitting.

Whenever centerline dimensions are given on the contract drawings, they govern.

3.18 Numbering Systems

This section describes the numbering system to be used for drawings and components of systems. Components include equipment, piping, valves, motors, circuit breakers, controls, protective devices, instruments, alarms, wire, and all other devices necessary to make up a complete system which may be functionally tested and operated.

3.18.1 Equipment Numbering

The purpose of equipment numbering is to uniquely identify each piece of equipment in the facility. The equipment number consists of two elements: equipment ID, and a sequence number.

C - 01

Where:

C = Equipment Identifier
01 = Sequential Numbers

A. First Element (Equipment Identifier)

The equipment or package identifier is an alpha designator. Mechanical and electrical equipment identifiers are found in Table 3-5. Instrumentation is identified by ISA nomenclature.

B. Second Element (Equipment Sequential Number)

The equipment sequential number is a two-digit number used to identify specific equipment in a process area.

The sequence for equipment numbers should be assigned following the direction of flow.

Table 3-5
Mechanical and Electrical Equipment Identifiers

Letter Designator	Group Description
A	Mixing Equipment
AF	Air Filters
AHU	Air Handling Units
AS	Acoustic Silencers
B	Boilers
C	Compressors
CAC	Computer Room Air Conditioners
D	Dewatering Equipment
E	Engines
F	Fans, Blowers
FCV	Flow Control Valves
G	Gates
H	Heat Exchangers
HV	Manual, Check Valves
LP	Lighting Panel
MCC	Motor Control Centers
O	Conveyors
P	Pumps
PCV	Pressure Control Valves
PP	Power Panels
T	Tanks
TCV	Temperature Control Valves
V	Valves
Y	Expansion Joints
ME	Miscellaneous Equipment

3.18.2 Equipment Schedules

Major pieces of equipment may be listed on schedules when the contract requires multiple units. Schedules refer to locations on drawings and in the specifications where more complete information is given.

Schedules on the drawings should list:

Equipment number
Equipment name, type and size
Type of service
Drawing where shown in plan
Specification section

3.18.3 Pipe Line Numbering

The purpose of pipe numbering is to uniquely identify each pipe in the facility. Each pipe number consists of four elements. The first element represents the pipe size in inches. The second element identifies the fluid flowing in the pipe. The third element represents the material of the pipe and type of fittings as a group. The fourth element represents the sequential number.

10 - RW - (29) - 01

Where:

10	=	Piping Size[(a)]
RW	=	Fluid Abbreviation[(a,b)]
(29)	=	Piping Material[(a)]
01	=	Sequential Number[(b)]

(a) This element should be used on piping callouts on mechanical drawings.
(b) This element should be used on piping callouts on P&ID drawings.

When the sequential number is used, these guidelines should be followed:

A. Process Piping

- Assign a separate number to each line.
- Assign a single number to all drains or vents from one piece of equipment.
- Assign a separate number to each drain and vent line from different pieces of similar equipment. If manifolded together, assign one number to an entire manifold.
- Assign a bypass pipe the same number as the inlet and outlet headers if the bypass line has a single valve. However, if the bypass line has two valves, assign a separate number to the pipe between valves.
- Assign a separate number to each pipe on multiple pipes between two pieces of equipment.

- Assign a separate number to each header.
- Assign the same number as the main piping run up to the isolation valve on a branch of the main run.
- Assign a separate number for each significant pressure change in the line.
- Assign separate numbers for each material class.
- Assign separate numbers when a pipe changes sizes.

3.18.4 Valve Numbering

All valves should be identified as to type and numbered according to the ISA system. Only instrument air valves are excluded.

For example, the first manual valve for fluid abbreviation RW would be:

RW - HV - 01

Where:

RW	=	Fluid Abbreviation
HV	=	Manual Valve
01	=	Sequential Number

3.18.5 Cable Numbering

Power, control and signal cables are each assigned a unique identification number. Power cable is identified using the following system:

MCC2 - 4 - A

Where:

MCC2	=	Denotes MCC number 2
4	=	Denotes circuit number 4
A	=	Suffix for special cases. AA@ for continuation of cable on secondary side of transformer
X	=	Denotes spare conduit

Control and signal cable are identified using the following system:

S - 2

Where:

S	=	Type of Cable - "C" for control cable; "S" for signal cable
3	=	Sequential number

3.18.6 Instrument and Loop Numbering

Each instrument should be designated by an alphanumeric number consisting of functional identification letters and a loop number. For functional identification letters, see Piping and Instrumentation Diagram Symbols and Legend, Figure 3-17. These guidelines should be followed in numbering instruments and loops.

- Identify an instrument according to its function. For example, a differential-pressure recorder used for flow measurement should be functionally identified as "FR"; a pressure indicator and a pressure-actuated switch connected to the output of a pneumatic level transmitter should be functionally identified as "LI" and "LS", respectively.

- Select the first letter of the functional identification according to the measured or initiating variable, not the manipulated variable. For example, a control valve which varies flow in response to a level controller should be functionally identified as "LCV" not "FCV."

- Use the succeeding letters of the functional identifiers to designate one or more readout or passive functions and/or output functions. A modifying letter may be in addition to one or more succeeding letters. Modifying letters may modify either a first letter or succeeding letters. For example, "TDAL" contains two modifiers; the "D" changes the measured variable "T" into a new variable, "temperature differential." The letter "L" restricts the readout function "A" to represent a low alarm only.

- The sequence of the functional identifier begins with one letter which designates the measured or initiating variable. Readout or passive letters may follow in any order with output functional letters following these in sequence except that output letter "C" (control) precedes output letter "V" (valve), i.e., "PCV," a pressure control valve. When modifying letters are used, interpose them so that they immediately follow the letters they modify.

- Symbolize multiple function device by showing a bubble for each measured variable, output and function. For example, a temperature controller with an integral switch is symbolized by two tangent bubbles: one functionally identified as "TC" and the other as "TSH." The instrument is functionally identified as "TC/TSH" in the specifications.

- The number of functional letters used for any one instrument must not exceed four. The number of functional letters should be kept to a minimum by arranging the functional letters into subgroups or by omitting the "I" (indicate) if an instrument both indicates and records the same measured variable. All letters in the functional identifiers must be upper case.

- Each instrument loop must have a unique number not assigned to any other loop at the facility. Each instrument in a loop must have the same loop number.

- An instrument common to two or more loops must carry the identification of the loop considered predominant.

- Loop numbering is serial, using a single sequence of numbers regardless of the loop function. For example, loops would be numbered:

  TIC - 001
  FRC - 002
  LIC - 003

- If a loop has more than one instrument with the same function, a suffix is appended to the loop number according to the following:

  (1) Use only an upper case letter
  (2) Alternate letters and numbers for further loop subdivisions

  For example, the primary elements for a multipoint pressure recorder would be:

  PE - 25A
  PE - 25B
  PE - 25C

- Instrument accessories such as purge meters, air sets, and seal pots that are not explicitly shown on a drawing, but which need a designation for other purposes should be tagged according to their function using the same loop identification as the instruments they directly serve. For example, an orifice flange union associated with orifice plate "FE-7" should be tagged "FX-7."

3.18.7 Drawing Numbering

Each Water CIP project is assigned a five-digit number by the Engineering Maps and Records Section of the Development Services Department. Every construction drawing carries the project number, a sequential number within the set, and the drawing size designation "D′′ in the lower right-hand corner of the title block.

For example:

19905 - 01- D

Project No.	19905
Sequential Sheet No.	01
Drawing Size Designation	D

The DESIGN CONSULTANT assigns internal sheet numbers by the discipline involved. Within each discipline, sheets are numbered sequentially by subject in the order listed below.

Subject

Plans
Sections
Elevations
Details
Schedules

An example is:

M - 13

Where:

M = Mechanical Discipline Drawing (Table 3-6)
13 = Sheet 13 of the Mechanical Drawings

Discipline designators are shown in Table 3-6.

Table 3-6
Discipline Designators

Discipline	Prefix
General	G
Demolition	D
Civil	C
Landscape	L
Architectural	A
Structural	S
Mechanical	M
Electrical	E
Instrumentation	I
Traffic Control	T

3.19 Sequence of Drawings

Drawings are arranged in the volume of contract drawings according to the following:

General Drawings

Cover Sheet
Overall Site Plan
List of Drawings
General and Project Notes
Abbreviations and Symbols
Traffic Control Plan or Project Notes
Design Criteria
Flow Diagram
Hydraulic Profile

After the General Drawings, drawings are sequenced first by discipline, then by sheet sequence within the discipline. Subjects within the disciplines are arranged according to the following:

Demolition Drawings

Civil Drawings

Civil Plans
Plans and Profiles
Civil Details
Cathodic Protection Plans and Details

Irrigation and Landscaping Drawings

Irrigation Plans
Irrigation Details
Landscaping Planting Schedule
Landscaping Plans
Landscaping Details

Architectural Drawings

Architectural Plans, Sections and Elevations
Architectural Details
Architectural Schedules

Structural Drawings

General Notes and Design Criteria
Structural Plans and Sections
Structural Details

Mechanical Drawings

Mechanical Plans and Sections
Mechanical Details
Equipment Schedules
HVAC Schematics
HVAC Plans and Sections
HVAC Details
HVAC Equipment Schedules
Plumbing Schematics
Plumbing Floor Plans
Plumbing Details
Fire Protection Floor Plans
Fire Protection Details

Electrical Drawings

Electrical Plans
Electrical Details

Electrical Schedules
Electrical Diagrams

Instrumentation Drawings

Piping and Instrumentation Diagrams
Loop Diagrams
Logic Diagrams
Instrument Installation Details

Traffic Control Drawings

Traffic Control Index and Notes
Traffic Control Plans
Traffic Control Details
Resurfacing/Striping Plans
Resurfacing/Striping Details

3.20 Microfilm Reproduction

All drawings must be capable of producing acceptable prints when enlarged from 35mm microfilm records. Special attention must be given to avoid the following problems that cause poor microfilm quality:

- Inconsistent line weight and density
- Lettering that is fuzzy or too small
- Incomplete erasures from changes
- Smudges, dirt, stains, wrinkles and creases resulting from careless handling
- Insufficient space between lines and letters
- Overdrafting, such as excessive cross hatching and shading
- Drawings made to excessively small scales

3.21 Discipline Specifics

This section elaborates on the content of the drawings produced by the various disciplines.

3.21.1 Cover Sheet

The standard cover sheet for volumes of Water CIP drawings is shown in Figure 3-15. The DESIGN CONSULTANT places the vicinity and location maps on the cover sheet. The name of the consultant, engineer's declaration and block for stamp are also included on this sheet. The drawing number for this sheet is G-1.

3.21.2 General Drawings

General drawings present information which relates to the overall project, not to any single discipline. They are numbered in sequence. The number of general drawings depends on the size of the project. Information on sheets should be combined when possible. These drawings carry a "G – "number, in the following sequence.

A. Overall Site Plan

This drawing numbered G-2 follows G-1 in every project. It shows the entire project site. If the project site is too large to be shown with the necessary level of detail, the overall site plan may be used as a key map.

- All individual structures or process units must be identified. If the scale is small enough to prevent adequate size lettering, a structure or process numbering index should be used.
- The grid system must be shown on this plan along with the basis of bearing and any adjustment to plant north.
- The benchmark reference is also shown on this plan.
- The boundary of the property is shown with bearings and distances or coordinates.

B. List of Drawings

This drawing shows the list of design drawings with sheet numbers and drawing numbers identified.

C. General and Project Notes

This sheet presents information to the contractor on general and project notes the Standard Specifications for Public Works Construction, the standard drawings, and other requirements. It follows the list of drawings.

D. Abbreviations and Symbols

This sheet lists all the abbreviations and symbols used on the drawings. It follows the general and project notes.

E. Design Criteria

This sheet lists the design criteria for the project. (This sheet may not be required for the construction package.)

F. Flow Diagram

This schematic drawing shows where the liquids flow and how the major equipment and major valves are arranged. Major mechanical equipment is shown and labeled; major valves and instruments are shown but are not labeled. Flow diagrams are used for pumping plant facilities.

G. Hydraulic Profile

For a pump plant, the hydraulic profile should include the steady-state hydraulic grade line (working pressure), the maximum surge hydraulic grade line, and the minimum surge hydraulic grade line. The hydraulic profile should start from the pump plant and end at the reservoir. High and low water levels inside the suction forebay and ending reservoir should also be identified. Design data including flow rate, pipe diameter and Hazen-Williams coefficient used in developing the profile should be identified as notes.

Submit detailed hydraulic profile calculations to the Water CIP for inclusion in Water Department Records.

H. Traffic Control Notes and Index

Unlike the previous general drawings, this sheet is always numbered T-1 in contracts where it is used. It lists contractor requirements for general control of traffic at the site and indexes any plan sheets used to define specific traffic controls. Additional traffic control plans are numbered T-2, et seq.

3.21.3 Civil Drawings

Civil drawings are classified as follows:

A. Site Plan

Guidelines were discussed in Section 3.21.2, A.

B. Horizontal Control and Paving Plans

Each sheet may have a key index at the lower right corner with hatching to indicate the plan location on the site. The following should be shown on these drawings:

- The grid system with the grid reference at the perimeter.
- All existing structures/improvements with easy-to-identify join lines at the interface. New improvements should be shown solid to stand apart from existing structures which are to be shown dashed or screened.
- Dimensions and coordinates of structures, roads and all surface features. Two coordinates are necessary to locate each structure.
- The various paving types clearly distinguishable to separate one from the other.
- Centerlines of point intersection (PI), curve data, road dimensions, etc., in sufficient quantity to locate all improvements without the need for calculations.
- Cross-referencing of sections and details associated with the paving.
- Catch basins, manhole, and other utility structures.

- Parking and striping with dimensions or coordinates, and traffic signs.
- Fences, with coordinates.
- Notes.

C. Grading and Drainage Plans

Each drawing may have a key index at the lower right corner with hatching to indicate the plan location on the site. The following should appear on these drawings:

- The grid system with the grid reference at the perimeter.
- Existing structures, contours and elevations shown screened or dashed.
- New contour lines and elevations of new improvements shown solid to stand out and be legible.
- Control points needed in addition to those of structures and pavement, shown with dimensions or coordinates.
- Drainage pattern with flow lines and ridges.
- Labeled transitions.
- Cross-referencing to sections or details associated with the grading.
- Notes.

D. Yard Piping Plans

Each drawing may have a key index in the lower right corner with hatching to indicate the plan location on the site. The following appear on these drawings:

- The grid system with the grid reference at the perimeter.
- Existing piping and structures dashed or screened.
- New improvements with solid lines.
- New piping showing coordinates, size, material and fluid to be conveyed.
- Existing piping, showing size, materials and fluid to be conveyed.
- Cross-referencing to profiles, sections and details associated with yard piping.

- Any temporary piping needed to maintain plant operations during construction.
- Any work by others which affects the yard piping.
- Invert elevations on gravity lines six inches and smaller which do not have a profile.
- Test stations and other cathodic protection equipment, as necessary.
- Notes.

E. Section Drawings

Section drawings include the following:

- Screened horizontal and vertical guide lines at 100-foot and 10-foot intervals, respectively.
- Existing ground lines and structures.
- New grade lines and structures.
- Depth of existing soil removal and reworking (to provide structural fill for new improvements).
- Extent and thickness of special materials such as select fill and gravel.
- Fencing.
- Subsurface drains (if required).
- Space limitations and other unusual constraints.
- Right of way (if required).
- Notes.

F. Profile Drawings

Profile drawings include the following:

- A profile number for each profile and reference plan numbers.
- Existing ground lines.
- New grade lines.

- New pipe centerline and appurtenances such as meters, manholes, coupling, valves, etc.
- Stations along horizontal distances to all pipe angle points, pipe appurtenances, tie-in, inlets, outlets and any other items necessary for fabrication and installation.
- All pipe crossings, pipe function, material, size, and elevation, including electrical and communications duct banks.
- All slopes.
- Bedding conditions and pipe class or strength, coating and lining requirements.
- For storm drain, Q and hydraulic grade for each reach, as well as invert elevations.
- Concrete encasements where needed.
- Casing where needed and casing data.
- Special pipe supports where needed.
- Manway, meter box or vault, valve box or vault
- Notes.

G. Detail Drawings

These drawings are used as needed to clearly show design details.

H. Demolition Plans

These drawings may have a key index at the lower right hand corner with hatching to indicate the plan location on the site. Demolition drawings show the following:

- The grid system with the grid reference at the perimeter
- Existing conditions.
- Items requiring removal with circled numbers keyed to the notes.
- Large areas or structures requiring removal with hatched lines for ease of identification.
- Items to be protected with squared numbers keyed to the notes.
- Items to be salvaged and relocated with circled number within a square box keyed to notes.

I. Offsite Plan and Profile Drawings

These drawings apply to pipelines within the public right-of-way and outside a facility site. Plan and profile sheets should adhere to the following guidelines:

1. The drawings should consist of two parts: the top part, a profile; and the bottom part, a construction plan with the pipeline superimposed on it.

2. The vertical and horizontal reference lines for the profile should be selected to minimize distortions and maximize clarity. Reference lines should be screened or of light weight so as not to interfere with the information to be communicated.

3. The profile must show the elevations and stationing and the existing ground line over the pipe line, a finished grade if applicable, the top and bottom of the pipe, all lines crossing the new pipeline and special conditions such as concrete encasement or steel casing for boring.

4. In addition, the profile shows manways, meter box or vault, valve box or vault, and other appurtenant items. Also, shown are the class of pipe, the length of the pipe, and the slope of pipe between grade changes. Degree if changing direction.

5. Station lines must be shown at manways, elbows, grade breaks and horizontal bends with centerline elevations and slopes between them.

6. The plan must show existing contours, existing improvements dashed or screened so as to stand out from the new improvements which are solid lines. Plans should show stations for the manways, elbows and other appurtenances to correspond with the profile stationing.

7. The plan must show right-of-way and temporary construction easements.

8. The plan must show referencing to sections and details shown on other sheets or on the same sheet.

9. In addition to stationing, the plan must show pipeline coordinates and bearings to allow location from survey monuments. Identify the pipeline by name.

10. The plan should also show special conditions to alert the contractor for construction requirements which may be out of the ordinary, such as cathodic protection equipment, such as rectifiers, test suctions, isolating flanges, etc., on plan view.

11. Provide a summary of hydraulic design criteria, including a hydraulic profile, for the pipeline on one of the general sheets.

12. Pipeline stationing always increases from left to right across each plan and profile drawing and continue through curves.

13. Pipeline stationing, where possible, increases in the direction of water flow through a pipeline.

14. Each plan view must have a north arrow. These stationing criteria are to be satisfied regardless of the resulting orientation of the north arrow on the plan view. The second criterion can, however, be disregarded for site piping around such projects as pumping stations or reservoirs. In these cases the direction of the north arrow should generally match the facility plan sheet.

15. Call out horizontal points of intersection (HPIs) on the plan and vertical points of intersection (VPIs) and combined angles on the profile.

16. Show and station the centerline of the pipe on the plan view and at VPIs in the profile for all pipes larger than 40 inches.

17. Provide a survey control drawing to include basis of bearing, coordinates, benchmarks, coordinates of critical locations, and coordinates at survey points. Show and identify any control points that also appear within the areas covered by the plan and profiles sheets.

Figure 3-16 is an example of a blank plan and profile sheet.

3.21.4 Landscaping/Irrigation

The DESIGN CONSULTANT should use the symbology from the City of San Diego and Regional Standard Drawings.

3.21.5 Architectural Drawings

Whether or not a separate set of architectural drawings is planned, a building code analysis of any building and site is performed and included in the set of drawings.

When a separate set of architectural drawings is planned, the following drawing classifications are the minimum components of the set:

- Building Code Analysis
- General Notes, Materials Legend, Architectural Abbreviations
- Plans, Sections and Elevations
- Door, Window, Louver and Finish Schedules and Details
- Standard Details

A. Building Code Analysis

The building code analysis includes the following:

- Design Code used (e.g., Uniform Building Code, 1997 Edition.)

- Any other applicable codes or references used (e.g., NFPA 101)

- The following minimum information should appear on the drawings with respect to the code analysis:

  - Occupancy Group(s) and actual floor area(s)
  - Type of Construction
  - Location on Property (relativity of all buildings on site)
  - Actual versus allowable floor areas
  - Is area increase required?
  - Are alarms required?
  - Diagram existing provisions
  - Fire Resistive Construction Requirements, both as a result of construction type and of special occupancy requirements
  - Exiting Loads and Diagrams for any building in which the public is allowed

B. General Notes, Materials Legend and Architectural Abbreviations

The general notes, materials legend and abbreviations include the following:

- General notes should not contain specification information.

- A legend identifying the graphic symbols used and textures shown in the plans, sections and details to identify various materials if specific to the architectural discipline and not shown elsewhere.

- Any special abbreviations used specific to the architectural discipline and not shown elsewhere.

C. Plans, Sections, and Elevations

Plans, sections and elevations include the following:

- Drawings should contain sizes and materials. Specifications should describe the materials and installation methods.

- Materials should be called out on drawings in the same terminology as they are specified. Avoid repetition and duplication of information found on other discipline drawings.

- When drawings of other disciplines are referenced, the specific drawing or detail should be noted.

- When match lines are used, they should be located in the same place on the drawings of all disciplines.

- Wherever possible, draw all plans at the same scale.

- Show information only once. Dimensions shown on small-scale plans should not appear on large-scale plans or vice versa.

- All disciplines should use the same orientation for their plans.

D. Door, Window, Louver, and Finish Schedule and Details

The use of standard formats for door, window, louver and finish schedules helps ensure consistency of the documents.

E. Details

These drawings are used as needed to clearly show design details.

F. Minimum Information Required on Architectural Drawings

- The following information appears on architectural drawings as a minimum requirement regardless of policy, even if shown on other discipline drawings:

- All plan dimensions, starting with building out-to-out measured at outside face of walls. Plan dimensions include all wall locations and thicknesses, all openings through slabs (but located and sized on structural), door, window and louver opening dimensions and locations, interior partition dimensioned locations and thicknesses, and centerline locations of all beams, columns, pilasters and piers.

- Rooms should be named and numbered; doors, windows and louvers should be designated by number or letter.

- Show and locate all fire extinguisher cabinets and devices.

- Show size and location of all architecturally relevant items such as tack or marker boards, built-in cabinets or millwork, lockers, etc.

- If not shown on structural drawings, show stair width, number and height of risers, number and length of treads, overall dimensions and landing sizes.

- Show all slab penetrations including sumps and floor drains (but location dimensions should appear on structural plans).

- Show structural separations and similar features. Reference details.

- If existing structures are relevant (i.e., part of same facility) or critical (i.e., sufficiently near to possibly impact construction efforts), show these facilities with phantom lines; note as existing.

- Roof slopes should be shown and called out, and elevations at high and low points provided.

- All sections and details needed should be provided unless covered by note or reference (as to standard/typical details or other discipline drawings). Sections are sufficient to cover all unique conditions without being repetitious. Sections should show interface conditions between architectural and other disciplines, drawn at a scale to clearly show required information and referencing to details.

- Details are generally used to enlarge nontypical features, which must be drawn at a larger scale.

- Detailed materials, components and features are clearly indicated.

- Additional information includes ladders, stairs, handrails, grating (by material and thickness), access covers (also by material and thickness), access hatches and scuttles (by material and size) and doors, windows and louvers.

3.21.6 Structural Drawings

Structural drawings may be classified in three groups: the structural general notes and design criteria drawing, the standard/typical details drawing(s), and the design drawings.

A. Structural General Notes and Design Criteria

This drawing shall be the first structural drawing. The structural general notes and design criteria drawing(s) include the following:

1. Reference Codes, Standards, and Design Loads

    - Design code used (e.g., Uniform Building Code, 1997 Edition)

    - Reference standards used (e.g., American Welding Society D1.4)

    - Geotechnical report reference, with soils bearing and lateral pressures

    - Assumed live loads used in design, including hydraulic forces if applicable

    - Seismic zone and seismic coefficients used (or wind forces if govern)

    - Any other applicable codes or references used as needed

2. Materials and Materials Standards

- Concrete strength, $f'c$ used in design (may vary for different uses)
- Reinforcing steel grade and ASTM designation
- Structural steel grade and ASTM designation (as applicable)
- Aluminum alloy/stainless steel alloy (if used/where applicable)
- Grating section properties/materials/coatings/manufacturer
- Metal decking depth/gage/section properties/manufacturer (if used)
- Anchor bolt material by ASTM for cast-in-place anchor bolts
- Drilled in concrete anchors (epoxy or wedge) by manufacturer
- Any materials to be galvanized – by ASTM "G-XX" designation
- All other materials used by manufacturers or equal, or by ASTM designation

3. Notes, Legend, Abbreviations

- Additional general notes may be added as deemed appropriate by the DESIGN CONSULTANT. These can include notes regarding coordination with other discipline drawings, verification of existing conditions, construction safety orders, verification of equipment sizes and anchorage with approved vendor shop drawings, etc.
- A legend identifying the graphic symbols used and textures shown in the sections to identify various materials.
- Any special abbreviations used specific to the structural discipline not shown elsewhere.

B. Standard/Typical Details

The use of well-established, time-proven standard/typical details, refined and improved over time as needed to reflect current materials and methods ensures a more consistent approach to drawing presentation. The standard/typical detail drawings should follow the drawing or drawings above as the next in numerical sequence. The division of information between standard/typical details and design drawings use the following guidelines:

- Standard/typical details include any frequently occurring detail for which a standard exists. These details may be included on the full-size standard/typical details drawings, or if in 8-1/2 x 11-inch format, bound

into the specifications or included as a separate volume of the Bid Documents. Water CIP standard details are included in Book 3. City of San Diego standard details may be obtained directly from the City.

- When used, each typical detail is referenced at least once on the plans. The typical details must be appropriate for, and coordinated with, the design drawings.

- Standard/typical details can be any condition occurring more than once. Examples include ladders, grating, access covers, metal stairs, concrete stairs, handrails, connection details (such as steel beam to concrete, steel beam to steel beam or column, etc.), concrete embedment such as frames, and all similar detail information that may apply to one or more locations or more than one structure.

C. Design Drawings

The structural design drawings prepared must include the plans, sections, elevations, and detail drawings containing all job-specific information. In general, the structural drawings show all information needed to build the complete structure, or show where it can be found.

Avoid repetition and duplication of information found on other discipline drawings. The structural drawings need not repeat the wall opening dimensions provided for windows and doors shown on the architectural drawings, although the openings should appear on the structural drawings.

Minimum information required on structural drawings — The following information must appear on the structural drawings as a minimum requirement regardless of policy, even if shown on other discipline drawings:

- All plan dimensions, starting with building out-to-out measured at outside face of walls. Plan dimensions include all wall locations and thickness, locations of edge of slab or change in elevation, size and location of all openings through slabs, and centerline locations of all beams, columns, pilasters, piers and similar structural features. These locations are tied to key functional elements within the structure by centerline location such as a large diameter pipe or manifold within the structure, pump or pumps locations, pipe or vessel support saddles, or similar features in each direction.

- Unless size is dictated by vendor-specific information, show size and location of all equipment pads and piers.

- Show stair width, rise, run, and overall dimensions and landing sizes, unless the same information is shown on architectural drawings.

- Locate all slab high and low points, including sumps and floor drains, by dimension or note.

- Locate all construction, contraction and expansion joints, structural separations and similar features.

- If existing structures are relevant (i.e., part of same facility) or critical (i.e., sufficiently near to possibly impact construction efforts), show these facilities with phantom lines; note as existing, and provide plan reference dimensions.

- Show all elevations and slopes. This includes bottom of footing elevation, invert elevation of all fill concrete, and all top-of-concrete elevations at high and low points, slabs, and landings. Where slope is provided, it should be noted as uniform between high point and low point elevations.

- For large diameter pipes passing through walls, or large horizontal vessels, provide centerline or invert dimensions.

- Where steel members are used, top-of-steel dimensions are provided and noted high point, low point, or typical.

- All sections and details needed are provided unless covered by note or reference. Sections are concise representations of wall and slab conditions drawn at a scale to clearly show reinforcing steel, joints, wall type and thickness. Avoid showing information occurring beyond the section cut.

- If complex wall penetrations occur and are not shown on architectural drawings, and wall openings such as doors, windows, louvers, etc. are needed, draw wall elevations and note/reference accordingly.

- Details are generally used to enlarge nontypical features which must be drawn at a larger scale. A detail referenced from the plan shall appear as an enlarged plan view, and a detail referenced from a section shall appear as an enlarged section. If other views are required, they may be developed from this principal view.

- Clearly indicate detailed materials, components, and features. Materials such as metal decking are shown, including depth, gage, section properties, material and finish, and required welding. Clearly show all embedded hardware. Wherever possible, use schedules to present information.

- Additional information is often associated with the architectural drawings, but those features are identified on structural drawings for this work. These include ladders, stairs, handrails, grating (by material and thickness), access covers (also by material and thickness), access hatches and scuttles (by manufacturer's model number, material, and size) and doors, windows and louvers.

3.21.7 Mechanical Drawings

Mechanical drawings are classified as follows:

A. Area Drawings

Area drawings must show all the equipment inside and outside facility structures. Area drawings also show the routing and location of piping systems to ensure clearances between all components. Develop area drawings using the following guidelines:

1. System component identification in accordance with Subsection 3.18 of this manual. Piping callouts include size, fluid and piping material.

2. Show all piping, including process piping.

3. Illustrate existing piping and future piping and equipment shown on the drawing according to the line patterns on Figure 3-5.

4. Show insulation on short sections and note the class within the insulation outline.

5. Symbolize valve or in-line components to scale. Motor and air actuators are outlined to show clearances and orientation.

6. Terminal dimensions are not shown at the connection of piping to vendor furnished equipment.

7. Pipe supports, anchors, and instrumentation taps are shown and identified but not dimensioned.

8. High and low point vents and drains are noted if no system isometric is provided.

9. Place a key plan at the lower right-hand corner of each drawing to indicate how the plant is divided into areas and by cross-hatching to show the particular area that the drawing covers. Each drawing adjoining another area must have a match line and the number of the adjacent drawing. Any piping continuing from one area to another is identified at this line.

10. Draw plan views for each main floor level. When required, partial plans may be used. One longitudinal and one transverse section along with additional partial sections are generally all that are required.

    In addition, the following are shown on area drawings:

    - Column centerlines, outlines and designations
    - General outlines of building exterior walls
    - Doors, hatchways, elevators, stairs, platforms and ladders
    - Piping and ductwork

- Centerlines of rails and outline of cranes and monorails necessary to show clearances and hook limits

- Outlines of all equipment in adequate detail to indicate clearance and space requirements

11. Minimum headroom clearance is 7 feet 6 inches.

12. Valve handwheels are oriented for best operation, keeping them out of passageways while retaining easy operability.

B. Utility Drawings

Utility drawings are prepared using separate levels on architectural/structural backgrounds in accordance with Water CIP CADD Standards.

HVAC drawings show at least floor plans and roof plans (if roof-mounted equipment is involved). Single line ductwork and piping shall be shown for small systems, with ample room for installation. Double-line ductwork and piping are shown for large, complex systems with multiple disciplines occupying the same space. Critically important sections and details of installation, schematics of piping, air flow, and controls should also be presented. In addition, the design drawings include details of seismic supports, bracing and restraints.

American Society of Heating, Ventilating, and Air Conditioning, Inc. (ASHRAE) drafting nomenclature, symbols, and abbreviations are used. For all buildings subject to California Energy Commission (CEC) Energy Efficiency Standards compliance, the design drawings include design criteria based on ASHRAE/CEC weather data for the job location, all required architectural, mechanical, and electrical Title 24 compliance forms, completely filled out, signed and stamped by the respective discipline professional engineers, duly registered in the state of California.

The HVAC equipment included in the design is presented on the equipment schedules showing unit manufacturer and model numbers, service, location, type, design calculations, nominal capacity, electrical rating, optional equipment and features, and method of control.

Plumbing drawings show at least floor plans and roof plans (if roof-mounted equipment is involved). All toilet rooms show connections to the site utility drawings. Piping is routed to a location five feet from the building and is continued on the civil drawings. Critically important sections and details of installation, and schematics of piping, should also be presented. In addition, the design drawings include details of seismic supports, bracing and restraints.

The Uniform Plumbing Code (UPC) and American Society of Plumbing Engineers (ASPE) details, drafting nomenclature, symbols, and abbreviations are used. For all buildings subject to California Energy Commission (CEC) Energy Efficiency Standards compliance, the design drawings include design criteria based on ASHRAE/CEC data and Title 24 compliance forms, completely filled out, signed and stamped by the respective discipline professional engineers, duly registered in the state of California.

Fire protection drawings show at least floor plans showing fire system components.

National Fire Protection Association (NFPA) details, drafting nomenclature, symbols and abbreviations are used.

The fire protection equipment included in the design is presented on the equipment schedules showing unit manufacturer and model numbers, service, location, type, design calculations and nominal capacity.

C. Isometric Drawings

Isometric drawings provide clarity to piping layouts. They are helpful when a pipe stress analysis is required.

D. System Flow Diagrams

System flow diagrams are schematic drawings that show operational relationships between various components and define the design variables for the major modes of operation.

E. Major Equipment and Valve Schedule

The equipment schedule shows all the major equipment categorized using the abbreviations shown in Table 3-5, including equipment numbers, service, and equipment data. The valve schedule should show all major valves, including valve number, type of valve, and valve size.

F. Piping Schedule

The piping schedule includes the following information regarding piping and fittings:

- Materials
- Schedule or wall thickness
- Pressure ratings
- Types of joints
- Fittings
- Testing requirements
- Cleaning requirements

3.21.8 Electrical Drawings

Electrical drawings are classified as follows:

A. Symbol Lists, Abbreviations and General Notes

This drawing shows all the symbols and abbreviations used, as well as general notes giving special instructions to the contractor.

B. Site/Plot Plan

These drawings incorporate the following:

1. Arrangement of structures and roadways.

2. Underground distribution system including location of pullboxes, manholes and ducts.

3. Location of switchgear, motor control centers (MCCs), power panels, main control board, and major local control panels.

4. Area/parking lighting. The area/parking lighting plan is to be drawn on a separate sheet to avoid confusion with power and control plans.

5. Location of power service, utility substation and in-plant substations.

6. Key plan and orientation arrow.

7. Drawing references for each structure.

C. Overall Single Line Diagrams

This drawing is required for large and complex projects and must present the following:

1. A simplified single-line diagram showing the interconnections of all distribution switchgear, power transformers, distribution boards, MCCs, all major electrical equipment, emergency generators, and power panels.

2. Each equipment single-line diagram is referenced to a drawing where this equipment's single-line diagram shows in detail.

3. Identification of all major electrical equipment.

4. Identification of all power cable and conduits.

5. Sizes of all major electrical components and loads.

D. Single Line Diagrams

These drawings show the makeup and development of all medium voltage switchgear and power distribution to 4160V and 480V loads. These drawings incorporate the following:

1. Power service and revenue meter connections.

2. Main circuit breakers or fused disconnect switches for the main power entrance, power distribution, and motor control centers.

3. Motor loads complete with corresponding horsepower sizes, branch circuit breaker or fused disconnect switches, motor starters, branch circuit conductors, miscellaneous devices and components such as local

disconnecting means, speed controllers, power factor correcting capacitors, etc.

4. Miscellaneous electrical loads complete with corresponding circuit breakers, starters, contactors, disconnects, etc.

5. Single-line diagrams for panel or motor control centers must show:

   - Total connected loads including existing, proposed and future loads
   - Approximate maximum demand
   - Future additional loads
   - Bus ampacities
   - Bus bracing
   - Circuit numbers

6. Identification of all panels, motor control centers, feeders, subfeeders, branch circuit conductors and all loads.

7. Substation transformers complete with all protective equipment such as circuit breakers, disconnect switches, surge arresters, grounding resistors, protective relays, etc.

8. Electrical interlocks.

9. All instrumentation.

10. All local vendor furnished control panels with three-phase branch circuits to loads shown with all overcorrect devices, starters, feeder sizes and loads.

E. Schematic Diagrams

These diagrams show the following:

1. Control scheme for each electrical load
2. Interlocks between equipment controls
3. Locations of control components
4. Connections of electrical protective devices
5. Wire termination interphase points
6. Control power sources
7. Identification of all components

F. Electrical Equipment Elevations

Unless a specific situation arises in which it is important to show the elevation of a piece of electrical equipment, the only equipment elevation required is that of the main switchgear. This drawing shows the following:

1. Underground pull section.

2. The service section showing the main metering socket, CTs and PTs, and the main circuit breaker.

3. The distribution sections showing the number of distribution sections required. The location of the breakers in the distribution sections is left up to the electrical equipment vendors.

4. Future expansion is shown in dashed lines.

5. This drawing shows approximate dimensions for each section and an overall height.

6. Notes regarding the approval of the electrical utility company prior to manufacturing are also shown.

G. Power and Control Plans

These drawings show the following:

1. Physical locations and identification of electrical loads, control and process instrumentation devices.

2. Identification of power and control conduit runs.

3. Special routing of conduits.

4. Signal conduit runs.

5. Callouts to enlarged plans and details for special situations.

6. Components such as disconnect switches, lockout-stops, manual switches, cathodic protection rectifiers, pressure switches, solenoids, level switches, temperature switches, miscellaneous instruments, special control devices and panels, etc.

H. Conduit and Cable Schedules

These drawings show all conduits and cables for power and controls, with the following information:

1. Conduit/cable number
2. From
3. To
4. Via
5. Cable specification
6. Voltage
7. Insulation type
8. Grounding conductor size
9. Remarks

A separate schedule must be developed for instrumentation trunking cables.

No lighting branch circuits is shown on the above schedules.

I. Lighting Plans

These drawings show the following:

1. Physical locations of all lighting fixtures
2. Locations and identification of lighting control switches
3. Power conduit homeruns
4. Fixture identifications and number
5. Location of lighting power panels
6. Lighting fixture circuit numbers
7. Mounting heights of fixtures
8. Special junction or splice boxes

J. Receptacle Plans

These drawings show:

1. Physical locations of all receptacles
2. Power conduit homeruns
3. Locations of receptacle power panels
4. Receptacle circuit numbers
5. Special types of receptacles
6. All other details necessary to convey the intent of the design to the electrical contractor

3.21.9 Instrumentation Drawings

Instrumentation drawings are classified as follows:

A. Piping and Instrument Diagram

This drawing depicts schematically the basic equipment and the process that takes place within a facility. The P&ID shows pumps and connecting pipes, and the instruments used for controlling and monitoring the process.

The P&ID is a combined effort of various disciplines (mechanical process, piping, instrumentation and electrical) to ensure that the plant process is represented in a clear and logical sequence.

The P&ID is the foundation document used for understanding the process, and when used with other supporting documents, it provides the tool for troubleshooting and maintaining the facility.

Layout - The P&ID format, symbols, line work, notation and title block follow the standards provided in this chapter. The P&ID is mainly schematic. It may follow the layout when possible, but the process flows from left to right.

Symbols and Line Conventions - Instrument and equipment symbols are per the symbols and legend sheet shown in Figure 3-17. When additional symbols not shown in the legend sheet are required, use ANSI/ISA S5.1 standard symbols.

Instruments are represented by a bubble containing a functional identification and a loop sequential number identification. The functional identification may be two, three, or four letters (see legend sheet and subsection 3.18). The loop sequence is normally a three-digit number, or four-digit for large facilities.

Instrument signal lines may enter or leave the instrument bubble at any angle, preferably horizontally or vertically. Arrowheads are used as required to clarify the direction of flow on process, electrical or pneumatic lines. Crossing line work follows the rule that horizontal lines break when crossing vertical lines, except that instrument lines or process lines of lesser importance break when crossing larger lines.

Equipment Identification - Process equipment, e.g. pumps, compressors, etc. are identified alphanumerically as described in subsection 3.18, with capacity in English units, located directly below the equipment symbol.

Figure 3-18 shows a sample P&ID.

B. Process Flow Diagrams

For larger and more complex facilities, a process flow diagram is prepared. This type of drawing precedes the P&ID and provides a simplified version of the process. Its main purpose is to depict the relationship among the large equipment and process lines. The flow diagram also contains a matrix listing the mass balance data for each process line; i.e., flow rate, pressure, etc. The matrix and process lines are cross-referenced numerically to facilitate identification.

C. Loop Diagrams

Instrument loop diagrams are provided for each instrument loop. The loop diagram follows the format in ANSI/ISA S5.4. The loop diagram is an extension of the P&ID. It is a valuable tool during construction, checkout, startup, operation, and maintenance of a process plant. The loop diagram is laid out with the field instrument on the left and the electrical (or pneumatic) lines progressing right as they go through junction boxes, cabinets, and panels to the final connection point. The loop diagrams are coordinated with the power and control plans described in paragraph 3.21.8. Instrument symbols and tag numbers correspond with those shown on the P&IDs. Every connection point is identified by terminal numbers, wire and cable number, and whether the signal is analog or on-off digital. Additionally, the diagram includes the I/O address of every wire connected to the PLC or DCS as applicable. The loop is identified in the title block with the instrument loop number shown on the P&ID.

D. Logic Diagrams

Logic diagrams are prepared for complex control logic sequences that can not be described by logic descriptions. The logic diagrams are intended for the use of the PLC or DCS programmer and for the technician in troubleshooting a control problem. Logic diagrams are per ANSI/ISA S5.2, Binary logic Diagrams for Process Operations. The logic symbols in this standard may be used in combination with block symbols entailing a complex operation or vendor equipment whose logic is still unknown.

Worded descriptions may accompany the logic diagram for clarification and better understanding.

E. Instrument Data Sheets

Instrument data sheets per ISA-S20 must be prepared for each instrument provided in the project. The data sheet lists the process, mechanical, and electrical requirements of the instrument. The data sheets, in addition to providing valuable engineering information, are intended for procurement of the instrument. A bill of material or instrument index is not a substitute for the instrument data sheet since many features of the instrument covered in the data sheet are not covered in the bill of material. The instrument data sheet is filled out in its entirety and refers to the instrument tag number shown on the P&ID. The specification forms provided by ISA-S20 cover 28 types of instruments. If a data sheet form is not found in ISA-S20, a user-modified version may be supplied.

The instrument data sheets are sequentially numbered to facilitate referencing. They are identified with the project title and revision number.

F. Control Panel Layouts

The control panel layout drawing must contain four basic items: the front panel elevation, the interior panel elevation, a nameplate tabulation, and a component list. The front and interior elevations are drawn at an appropriate scale to provide clear detail of every feature shown. Overall dimensions are provided. Panel door hinge locations are also indicated. If a cabinet stand is provided it is also dimensioned. The nameplate list contains the panel name and equipment number. The nameplate is to be located on the top center of the panel. If the component list is too lengthy to fit on the drawing, it is included in the specifications and referred to on the drawing by note.

G. Instrument Installation Details

Typical installation details for each type of instrument must be provided in a diagrammatic fashion. A sequential identification number is used for each type of installation to be referred to in other project drawings. In addition, the tag numbers of the instruments the installation covers are listed. Refer to Book 3, Standard and Guide Details, for typical instrument installation details.

3.22 Standard Details

Water CIP standard details are found in Book 3, Standard and Guide Details. Water Department standard details may be obtained from the City of San Diego.

3.23 Standards and Procedures for Improvements Plans (Private Contracts)

All water facilities plans must be routed through the Water Utilities Plan Check Group for review and approval to ensure consistency.

The planning functions for private developments (i.e., water studies, systems layout and pipe sizing) are generally required of the land developer in the tentative map resolution. Any question of these aspects should be directed to the Water Utilities Engineering Division Planning Group or Engineering and Development group.

The Water Utilities Plan Check Group reviews the project for compliance with the tentative map requirements, design standards, and all applicable regional standard drawings. The Plan Check Group reviews the plans for special facilities, specifications and shop drawings.

In general, the City follows the AWWA standards and the SSPWC including Regional and City of San Diego Supplements.

3.23.1 Improvement Plans (Private Contracts)

All improvement plans must be prepared according to City of San Diego and this CIP Book 5, CADD Standards. Other drawing formats are not acceptable.

Improvement plans for pipelines must include the following information:

- *Title Sheet(s):* Location and vicinity maps; project tile; list of utility phone numbers; phone number for underground service alert; list of referenced improvement drawings; standard drawings; standard specifications references; list of abbreviations; legend; work to be done; standard notes; engineer of work, north arrow(s).

- *Plan and Profile Sheet(s)*: Scale; north arrow(s); screened profile grid; basis of bearings (if applicable); benchmark information; project title; existing and proposed contours over pipe; all existing or proposed utilities that may run parallel with or cross the new pipe; diameter of pipe; pipe material; concrete encasements; stream crossings, plan and profile of the proposed pipe(s).

- *Plan Strip*: Location of proposed pipe with horizontal ties to property and right-of-way boundaries or known and established physical improvements; all horizontal alignment information including stationing, horizontal curve data, location and description of structures.

- *Profile Strip*: Depth of cover; pipeline slopes; stationing; offsets (if applicable); bridge abutment locations and culvert crossings.

- *Details*: Special and complicated structures if not included in the regional standard drawings; complicated utility crossings; special manhole(s); special trenches; etc.

3.23.2 Notes on Improvement Plans

The following notes are normally required on the cover sheet of improvement drawings. Notes 1 and 2 can be omitted when there are no water services or sewer laterals. Notes 3, 4, and 5 can be omitted if there is no water main included in the improvements.

- *Note 1.* Each lot shall receive a 1-inch water service and a 4-inch sewer house connection, unless otherwise indicated on the plans or in the special provisions. The location is to be determined by the DESIGN CONSULTANT. The as-built locations shall be shown on the engineer=s field plans prior to acceptance of the water and sewer facilities.

- *Note 2.* Locate water services and sewer house connections out of driveways. The sewer house connection shall be separated a minimum of 5-feet down-slope from the water service.

- *Note 3.* All connections to existing water mains are to be done by City's Water Department for which the following fees will be charged:

  $_____ Item No. 1; Sheet No. ____, description
  $_____ Item No. 2; Sheet No. ____, 8x8x12 Tee
  $_____ Item No. 3; . . . . .

  If the connections are not ready to be made and the fees paid before the thirteenth month from approval, the City reserves the right to adjust the fees according to the fee schedule in effect at the time the connection is made. It is the responsibility of the contractor to expose the existing main at the connection point and to install the new main at the alignment and grade which will allow the City to make a "straight-in" connection without using more than 10 linear feet of pipe.

- *Note 4.* All valves shall be flanged to crosses and tees.

- *Note 5.* All ductile and gray cast iron fittings, valves, and appurtenances directly buried in the ground shall be coated with a liquid epoxy coating system per AWWA C-210 or a cold applied petroleum wax tape system per AWWA C-217.

- *Note 6.* In gated communities, the developer shall be responsible for providing Water Utilities Operations Division with keyed access.

The following specifications must be called out:

- Standard Specifications for Public Works Construction (most current approved edition).

- Regional Supplement Amendments to Standard Specifications (most current adopted edition).

- City of San Diego Supplement Amendments (most current adopted edition).

The following standard drawings must be called out:

- City of San Diego Standard Drawings (CSDSD) (latest edition).

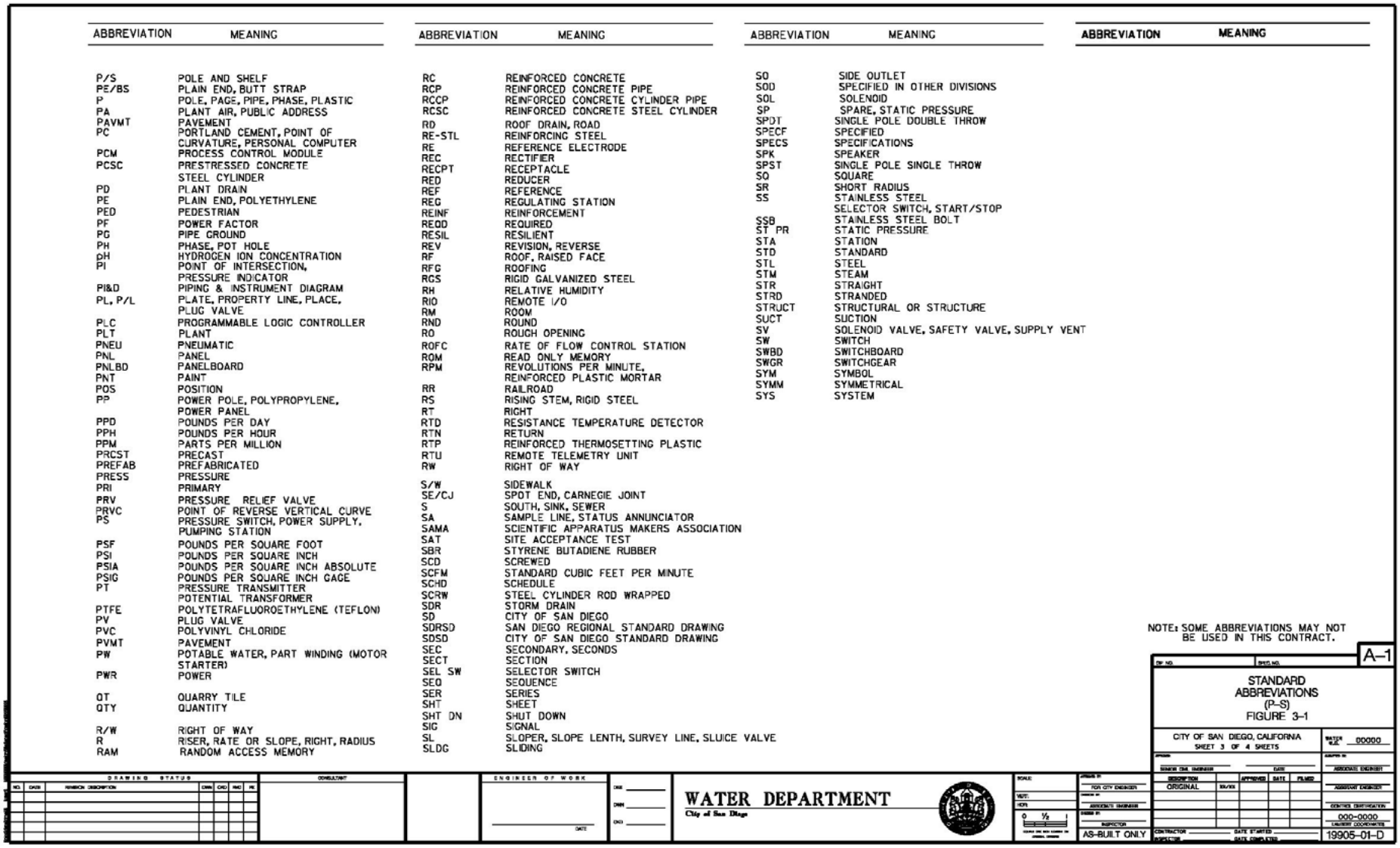
Should any Caltrans easements, rights-of-way, or structures be affected by the improvement plans, a note for the following plans is added:

- State of California Department of Transportation Standard Plans (latest edition).

3.23.3 Special Facilities Plan Check

Improvement plans for special facilities such as large water (18-inch and larger) are submitted to the appropriate operating division (responsible for maintenance) by the Engineering Division for review and comments. The Engineering Division then gives final approval of the plans. This plan check process information can be obtained from the Department of Development Services, City of San Diego.

Figure 3-1
Standard Abbreviations



ABBREVIATION	MEANING
P/S	POLE AND SHELF
PE/BS	PLAIN END, BUTT STRAP
P	POLE, PAGE, PIPE, PHASE, PLASTIC
PA	PLANT AIR, PUBLIC ADDRESS
PAVMT	PAVEMENT
PC	PORTLAND CEMENT, POINT OF CURVATURE, PERSONAL COMPUTER
PCM	PROCESS CONTROL MODULE
PCSC	PRESTRESSED CONCRETE STEEL CYLINDER
PD	PLANT DRAIN
PE	PLAIN END, POLYETHYLENE
PED	PEDESTRIAN
PF	POWER FACTOR
PG	PIPE GROUND
PH	PHASE, POT HOLE
pH	HYDROGEN ION CONCENTRATION
PI	POINT OF INTERSECTION, PRESSURE INDICATOR
PI&D	PIPING & INSTRUMENT DIAGRAM
PL, P/L	PLATE, PROPERTY LINE, PLACE, PLUG VALVE
PLC	PROGRAMMABLE LOGIC CONTROLLER
PLT	PLANT
PNEU	PNEUMATIC
PNL	PANEL
PNLBD	PANELBOARD
PNT	PAINT
POS	POSITION
PP	POWER POLE, POLYPROPYLENE, POWER PANEL
PPD	POUNDS PER DAY
PPH	POUNDS PER HOUR
PPM	PARTS PER MILLION
PRCST	PRECAST
PREFAB	PREFABRICATED
PRESS	PRESSURE
PRI	PRIMARY
PRV	PRESSURE RELIEF VALVE
PRVC	POINT OF REVERSE VERTICAL CURVE
PS	PRESSURE SWITCH, POWER SUPPLY, PUMPING STATION
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSIG	POUNDS PER SQUARE INCH GAGE
PT	PRESSURE TRANSMITTER POTENTIAL TRANSFORMER
PTFE	POLYTETRAFLUOROETHYLENE (TEFLON)
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE
PVMT	PAVEMENT
PW	POTABLE WATER, PART WINDING (MOTOR STARTER)
PWR	POWER
QT	QUARRY TILE
QTY	QUANTITY
R/W	RIGHT OF WAY
R	RISER, RATE OR SLOPE, RIGHT, RADIUS
RAM	RANDOM ACCESS MEMORY
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RCCP	REINFORCED CONCRETE CYLINDER PIPE
RCSC	REINFORCED CONCRETE STEEL CYLINDER
RD	ROOF DRAIN, ROAD
RE-STL	REINFORCING STEEL
RE	REFERENCE ELECTRODE
REC	RECTIFIER
RECPT	RECEPTACLE
RED	REDUCER
REF	REFERENCE
REG	REGULATING STATION
REINF	REINFORCEMENT
REQD	REQUIRED
RESIL	RESILIENT
REV	REVISION, REVERSE
RF	ROOF, RAISED FACE
RFG	ROOFING
RGS	RIGID GALVANIZED STEEL
RH	RELATIVE HUMIDITY
RIO	REMOTE I/O
RM	ROOM
RND	ROUND
RO	ROUGH OPENING
ROFC	RATE OF FLOW CONTROL STATION
ROM	READ ONLY MEMORY
RPM	REVOLUTIONS PER MINUTE, REINFORCED PLASTIC MORTAR
RR	RAILROAD
RS	RISING STEM, RIGID STEEL
RT	RIGHT
RTD	RESISTANCE TEMPERATURE DETECTOR
RTN	RETURN
RTP	REINFORCED THERMOSETTING PLASTIC
RTU	REMOTE TELEMETRY UNIT
RW	RIGHT OF WAY
S/W	SIDEWALK
SE/CJ	SPOT END, CARNEGIE JOINT
S	SOUTH, SINK, SEWER
SA	SAMPLE LINE, STATUS ANNUNCIATOR
SAMA	SCIENTIFIC APPARATUS MAKERS ASSOCIATION
SAT	SITE ACCEPTANCE TEST
SBR	STYRENE BUTADIENE RUBBER
SCD	SCREWED
SCFM	STANDARD CUBIC FEET PER MINUTE
SCHD	SCHEDULE
SCRW	STEEL CYLINDER ROD WRAPPED
SDR	STORM DRAIN
SD	CITY OF SAN DIEGO
SDRSD	SAN DIEGO REGIONAL STANDARD DRAWING
SDSD	CITY OF SAN DIEGO STANDARD DRAWING
SEC	SECONDARY, SECONDS
SECT	SECTION
SEL SW	SELECTOR SWITCH
SEQ	SEQUENCE
SER	SERIES
SHT	SHEET
SHT DN	SHUT DOWN
SIG	SIGNAL
SL	SLOPER, SLOPE LENTH, SURVEY LINE, SLUICE VALVE
SLDG	SLIDING
SO	SIDE OUTLET
SOD	SPECIFIED IN OTHER DIVISIONS
SOL	SOLENOID
SP	SPARE, STATIC PRESSURE
SPDT	SINGLE POLE DOUBLE THROW
SPECF	SPECIFIED
SPECS	SPECIFICATIONS
SPK	SPEAKER
SPST	SINGLE POLE SINGLE THROW
SQ	SQUARE
SR	SHORT RADIUS
SS	STAINLESS STEEL
SSB	SELECTOR SWITCH, START/STOP STAINLESS STEEL BOLT
ST PR	STATIC PRESSURE
STA	STATION
STD	STANDARD
STL	STEEL
STM	STEAM
STR	STRAIGHT
STRD	STRANDED
STRUCT	STRUCTURAL OR STRUCTURE
SUCT	SUCTION
SV	SOLENOID VALVE, SAFETY VALVE, SUPPLY VENT
SW	SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
SYM	SYMBOL
SYMM	SYMMETRICAL
SYS	SYSTEM

NOTE: SOME ABBREVIATIONS MAY NOT BE USED IN THIS CONTRACT.

A-1

STANDARD ABBREVIATIONS (P-S) FIGURE 3-1

CITY OF SAN DIEGO, CALIFORNIA
SHEET 3 OF 4 SHEETS

DRAWING STATUS

NO.	DATE	REVISION DESCRIPTION	DWN	CKD	RMD	PE

CONSULTANT

ENGINEER OF WORK

DATE

DES
DWN
CKD

WATER DEPARTMENT
City of San Diego

SCALE:
VERT:
HOR:
0 ½ 1

DESIGNED BY
FOR CITY ENGINEER
CHECKED BY
ASSOCIATE ENGINEER
DRAWN BY
INSPECTOR
AS-BUILT ONLY

DESCRIPTION	APPROVED	DATE	FILMED
ORIGINAL	XX/XX		

CONTRACTOR
INSPECTOR
DATE STARTED
DATE COMPLETED

WATER O.M. 00000

SENIOR CIVIL ENGINEER
DATE
ASSISTANT ENGINEER
ASSOCIATE ENGINEER
CONTROL CERTIFICATION
000-0000
LAMBERT COORDINATES
19905-01-D

ABBREVIATION	MEANING
F	DEGRESS FAHRENHEIT, FLANGE
FA	FIRE ALARM
FAB	FABRICATED
FAT	FACTORY ACCEPTANCE TEST
FB	FLAT BAR, FLOOR BEAM, FIELD BOOK
FBC	FURNISHED BY CITY
FBE	FUSION BONDED EPOXY
FC	FLEXIBLE COUPLING, FAIL CLOSE, FOOT CANDLE
FCA	FLANGE COUPLING ADAPTER
FCO	FLOOR CLEANOUT
FD	FLOOR DRAIN
FDN	FOUNDATION
FDR	FEEDER
FEXT	FIRE EXTINGUISHER
FF	FLAT FACE, FAR FACE, FINISH FLOOR
FG	FINISHED GRADE
FH	FIRE HYDRANT
FHMB	FLAT HEAD MACHINE BOLT
FIG	FIGURE
FIN	FINISHED
FIX	FIXTURE
FL	FLOWLINE, FLOOR
FLA	FULL LOAD AMPS
FLEX	FLEXIBLE
FLG	FLANGE
FLUOR	FLUORESCENT
FM	FORCE MAIN
FMH	FLEXIBLE METAL HOSE
FO	FAIL OPEN, FIBER OPTIC (CABLE)
FOB	FLAT ON BOTTOM
FOC	FACE OF CONCRETE
FOM	FACE OF MASONRY
FOR	FORWARD
FOS	FACE OF STUDS
FOT	FLAT ON TOP
FOW	FACE OF WALL
FPM	FEET PER MINUTE
FPS	FEET PER SECOND
FR	FRAME
FRP	FIBERGLASS REINFORCED PLASTIC
FS	FAR SIDE, FINISHED, SURFACE, FORGED STEEL, FACTOR OF SAFETY, FIRE SERVICE
FT	FEET, FOOT, FIELD TOP
FTG	FOOTING
FUT	FUTURE
FV	FULL VOLTAGE
FVNR	FULL VOLTAGE NON REVERSING
FW	FIELD WELD
FWD	FORWARD
FWY	FREEWAY
FX	FUSION EPOXY
G/B	GALVANIZED BOLT
GA	GAGE, GAUGE
GAF	GALVANIZED AFTER FABRICATION
GAL	GALLON
GALV	GALVANIZED
GALVI	GALVANIZED IRON
GEN	GENERAL, GENERATOR
GFA	GROOVED FLANGED ADAPTER
GIS	GEOGRAPHICAL INFORMATION SYSTEM
GL	GLASS, GLOBE VALVE

ABBREVIATION	MEANING
GND	GROUND
GPD	GALLONS PER DAY
	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
	GRADE, GROUND
GRC	GRADE BREAK, GRADE CHANGE
GRTG	GRATING
GSP	GALVANIZED STEEL PIPE
GV	GATE VALVE
GVBP	GATE VALVE WITH BYPASS
GYP	GYPSUM
H/A	HAND/AUTO
H/P	HIGH POINT
HB	HOSE BIBB
HDR	HEADER
HEX	HEXAGONAL
Hg	MERCURY
HGL	HYDRAULIC GRADE LINE
HGR	HANGER
HGT	HEIGHT
HH	HAND HOLE
HI	HIGH
HMW	HIGH MOLECULAR WEIGHT
HOA	HAND/OFF/AUTOMATIC
HOR	HAND/OFF/REMOTE, HORIZONTAL
HP	HORSEPOWER, HIGH PRESSURE
HR	HOUR
HTG	HEATING
HV	HORIZONTAL AND VERTICAL CONTROL POINT, HIGH VOLTAGE
HWL	HIGH WATER LEVEL
HYD	HYDRAULIC, HYDRANT
HZ	HERTZ
I/O	INPUT/OUTPUT
IA	INSTRUMENT AIR
ID	INSIDE DIAMETER, IDENTIFICATION
IE	INVERT ELEVATION
IF	INSIDE FACE
IL	INDICATING LAMP
IN	INCH
INC	INCANDESCENT
INSTR	INSTRUMENT
INSUL	INSULATION OR INSULATED
INTR	INTERIOR
INVT	INVERT ELEVATION
IP	IRON PIPE
IPS	IRON PIPE SIZE
IRR	IRRIGATION
ISA	INSTRUMENT SOCIETY OF AMERICA
JB	JUNCTION BOX
JC	JUNCTION CHAMBER
JT	JOINT
K	KILO
KA	KILO AMPERES
KCM	KILO CIRCULAR MILLS
KG	KILOGRAM
KM	KILOMETER
KV	KILOVOLT
KVA	KILOVOLT AMPERES

ABBREVIATION	MEANING
KVAR	KILOVAR
KW	KILOWATT
KWH	KILOWATT HOUR
L/P	LOW POINT
L/R	LOCAL/REMOTE
L	LITER, LENGTH, LEFT
LA	LIGHTNING ARRESTER
LB	POUND
LCP	LOCAL CONTROL PANEL
LEL	LOWER EXPLOSIVE LEVEL
LF	LINEAR FEET, LINE FILTER
LG	LENGTH, LONG
LL	LIVE LOAD
LOC	LOCAL, LOCATION
LONG	LONGITUDINAL
LOS	LOCK OUT STOP
LP	LOW PRESSURE, LIGHTING PANEL
LR	LONG RADIUS, LOCAL/REMOTE
LSP	LANDSCAPING SPRINKLER SYSTEM
LT	LIGHT, LEFT
LTG	LIGHTING
LTS	LIGHTS
LV	LOW VOLTAGE
LVL	LEVEL
LWL	LOW WATER LEVEL
LWR	LOWER
LYT	LAYOUT
M/W	WATER METER
M	METER, MALE (PIPE THREAD)
	MAIN COIL, MOTOR
mA	MILLIAMPS
MA	MANUAL/AUTO
MACH	MACHINE
MAG	MAGNETIC
MAN	MANUAL
MATL	MATERIAL
MAX	MAXIMUM
MCC	MOTOR CONTROL CENTER
MDM	MEDIUM
MECH	MECHANICAL
MET	METAL
MFR	MANUFACTURER
MG	MAGNESIUM
MGD	MILLION GALLONS PER DAY
MH	MANHOLE
MIL	MILITARY, 1/1,000 INCH
MIN	MINIMUM, MINUTE
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
MK	MARK
MMI	MAN MACHINE INTERFACE
MO	MOTOR OPERATED, MASONRY OPENING
MOD	MODIFY, MODIFIED
MON	MONUMENT
MOT	MOTOR
MOV	MOTOR OPERATED VALVE
MS	MANUAL SWITCH
MSL	MEAN SEA LEVEL
MT	MOUNT

ABBREVIATION	MEANING
MTC	MECHANICAL-TYPE COUPLING
MTD	MOUNTED, MULTIPLE TELEPHONE DUCT
MTG	MOUNTING
MTR	METERING STATION
MULT	MULTIPLE
MV	MEDIUM VOLTAGE
mV	MILLIVOLTS
N	NORTH, NEUTRAL
NA	NON-AUTOMATIC, NOT APPLICABLE
NBS	NATIONAL BUREAU OF STANDARDS
NC	NORMALLY CLOSED
NDL	NEEDLE VALVE
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURING ASSOCIATION
NEUT	NEUTRAL
NF	NEAR FACE
NFPA	NATINAL FIRE PROTECTION ASSOCIATION
NG	NATURAL GRADE
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN, NUMBER
NOM	NOMINAL
NOS	NUMBERS
NPS	NOMINAL PIPE SIZE (FORMERLY I.P.S.)
NPT	NATIONAL PIPE THREAD
NRS	NON-RISING STEM
NS	NEAR SIDE
NTS	NOT TO SCALE
OC	OVER-CROSSING, ON CENTER, OPEN/CLOSE
OCA	OPEN/CLOSE/AUTO
OCB	OIL CIRCUIT BREAKER
OCR	OPEN/CLOSE/REMOTE
OD	OUTSIDE DIAMETER, OVERALL DIMENSION
OE	OUTSIDE EDGE
OF	OUTSIDE FACE
OH	OVERHEAD
OL	OVERLOAD RELAY, OUTLET
OPER	OPERATOR
OPNG	OPENING
OPP	OPPOSITE
ORD	OVERFLOW ROOF DRAIN
OS & Y	OUTSIDE STEM AND YOKE
OUT	OUTPUT
OVFL	OVERFLOW
OVHD	OVERHEAD
OZ	OUNCE

NOTE: SOME ABBREVIATIONS MAY NOT BE USED IN THIS CONTRACT

A-1

STANDARD ABBREVIATIONS (F-O) FIGURE 3-1

CITY OF SAN DIEGO, CALIFORNIA
SHEET 2 OF 4 SHEETS

WATER I.A.# 00000

DRAWING STATUS

NO.	DATE	REVISION DESCRIPTION	DRN	CHD	PMC	PE

CONSULTANT

ENGINEER OF WORK

DATE

DRN

DWN

CHD

WATER DEPARTMENT
City of San Diego

SCALE:

0 ½ 1

APPROVED BY
FOR CITY ENGINEER

DESIGNED BY
ASSOCIATE ENGINEER

DRAWN BY
INSPECTOR

AS-BUILT ONLY

DESCRIPTION	BY	APPROVED	DATE	P.E. NO.
ORIGINAL				

ASSOCIATE ENGINEER

ASSISTANT ENGINEER

CONTROL CERTIFICATION

000-0000
LAMBERT COORDINATES

CONTRACTOR
DATE STARTED
DATE COMPLETED

19905-01-D

ABBREVIATION	MEANING
P/S	POLE AND SHELF
PE/BS	PLAIN END, BUTT STRAP
P	POLE, PAGE, PIPE, PHASE, PLASTIC
PA	PLANT AIR, PUBLIC ADDRESS
PAVMT	PAVEMENT
PC	PORTLAND CEMENT, POINT OF CURVATURE, PERSONAL COMPUTER
PCM	PROCESS CONTROL MODULE
PCSC	PRESTRESSED CONCRETE STEEL CYLINDER
PD	PLANT DRAIN
PE	PLAIN END, POLYETHYLENE
PED	PEDESTRIAN
PF	POWER FACTOR
PG	PIPE GROUND
PH	PHASE, POT HOLE
pH	HYDROGEN ION CONCENTRATION
PI	POINT OF INTERSECTION, PRESSURE INDICATOR
PI&D	PIPING & INSTRUMENT DIAGRAM
PL, P/L	PLATE, PROPERTY LINE, PLACE, PLUG VALVE
PLC	PROGRAMMABLE LOGIC CONTROLLER
PLT	PLANT
PNEU	PNEUMATIC
PNL	PANEL
PNLBD	PANELBOARD
PNT	PAINT
POS	POSITION
PP	POWER POLE, POLYPROPYLENE, POWER PANEL
PPD	POUNDS PER DAY
PPH	POUNDS PER HOUR
PPM	PARTS PER MILLION
PRCST	PRECAST
PREFAB	PREFABRICATED
PRESS	PRESSURE
PRI	PRIMARY
PRV	PRESSURE RELIEF VALVE
PRVC	POINT OF REVERSE VERTICAL CURVE
PS	PRESSURE SWITCH, POWER SUPPLY, PUMPING STATION
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSIG	POUNDS PER SQUARE INCH GAGE
PT	PRESSURE TRANSMITTER POTENTIAL TRANSFORMER
PTFE	POLYTETRAFLUOROETHYLENE (TEFLON)
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE
PVMT	PAVEMENT
PW	POTABLE WATER, PART WINDING (MOTOR STARTER)
PWR	POWER
QT	QUARRY TILE
QTY	QUANTITY
R/W	RIGHT OF WAY
R	RISER, RATE OR SLOPE, RIGHT, RADIUS
RAM	RANDOM ACCESS MEMORY
RC	REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RCCP	REINFORCED CONCRETE CYLINDER PIPE
RCSC	REINFORCED CONCRETE STEEL CYLINDER
RD	ROOF DRAIN, ROAD
RE-STL	REINFORCING STEEL
RE	REFERENCE ELECTRODE
REC	RECTIFIER
RECPT	RECEPTACLE
RED	REDUCER
REF	REFERENCE
REG	REGULATING STATION
REINF	REINFORCEMENT
REQD	REQUIRED
RESIL	RESILIENT
REV	REVISION, REVERSE
RF	ROOF, RAISED FACE
RFG	ROOFING
RGS	RIGID GALVANIZED STEEL
RH	RELATIVE HUMIDITY
RIO	REMOTE I/O
RM	ROOM
RND	ROUND
RO	ROUGH OPENING
ROFC	RATE OF FLOW CONTROL STATION
ROM	READ ONLY MEMORY
RPM	REVOLUTIONS PER MINUTE, REINFORCED PLASTIC MORTAR
RR	RAILROAD
RS	RISING STEM, RIGID STEEL
RT	RIGHT
RTD	RESISTANCE TEMPERATURE DETECTOR
RTN	RETURN
RTP	REINFORCED THERMOSETTING PLASTIC
RTU	REMOTE TELEMETRY UNIT
RW	RIGHT OF WAY
S/W	SIDEWALK
SE/CJ	SPOT END, CARNEGIE JOINT
S	SOUTH, SINK, SEWER
SA	SAMPLE LINE, STATUS ANNUNCIATOR
SAMA	SCIENTIFIC APPARATUS MAKERS ASSOCIATION
SAT	SITE ACCEPTANCE TEST
SBR	STYRENE BUTADIENE RUBBER
SCD	SCREWED
SCFM	STANDARD CUBIC FEET PER MINUTE
SCHD	SCHEDULE
SCRW	STEEL CYLINDER ROD WRAPPED
SDR	STORM DRAIN
SD	CITY OF SAN DIEGO
SDRSD	SAN DIEGO REGIONAL STANDARD DRAWING
SDSD	CITY OF SAN DIEGO STANDARD DRAWING
SEC	SECONDARY, SECONDS
SECT	SECTION
SEL SW	SELECTOR SWITCH
SEQ	SEQUENCE
SER	SERIES
SHT	SHEET
SHT DN	SHUT DOWN
SIG	SIGNAL
SL	SLOPER, SLOPE LENTH, SURVEY LINE, SLUICE VALVE
SLDG	SLIDING
SO	SIDE OUTLET
SOD	SPECIFIED IN OTHER DIVISIONS
SOL	SOLENOID
SP	SPARE, STATIC PRESSURE
SPDT	SINGLE POLE DOUBLE THROW
SPECF	SPECIFIED
SPECS	SPECIFICATIONS
SPK	SPEAKER
SPST	SINGLE POLE SINGLE THROW
SQ	SQUARE
SR	SHORT RADIUS
SS	STAINLESS STEEL SELECTOR SWITCH, START/STOP
SSB	STAINLESS STEEL BOLT
ST PR	STATIC PRESSURE
STA	STATION
STD	STANDARD
STL	STEEL
STM	STEAM
STR	STRAIGHT
STRD	STRANDED
STRUCT	STRUCTURAL OR STRUCTURE
SUCT	SUCTION
SV	SOLENOID VALVE, SAFETY VALVE, SUPPLY VENT
SW	SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
SYM	SYMBOL
SYMM	SYMMETRICAL
SYS	SYSTEM

NOTE: SOME ABBREVIATIONS MAY NOT BE USED IN THIS CONTRACT.

A-1

STANDARD ABBREVIATIONS (P-S)
FIGURE 3-1

CITY OF SAN DIEGO, CALIFORNIA
SHEET 3 OF 4 SHEETS

WATER O.M. 00000

DRAWING STATUS

NO.	DATE	REVISION DESCRIPTION	DWN	CHD	PMC	PE

CONSULTANT

ENGINEER OF WORK

DATE

DES
DWN
CHD

WATER DEPARTMENT
City of San Diego

SCALE: 0 1/2 1

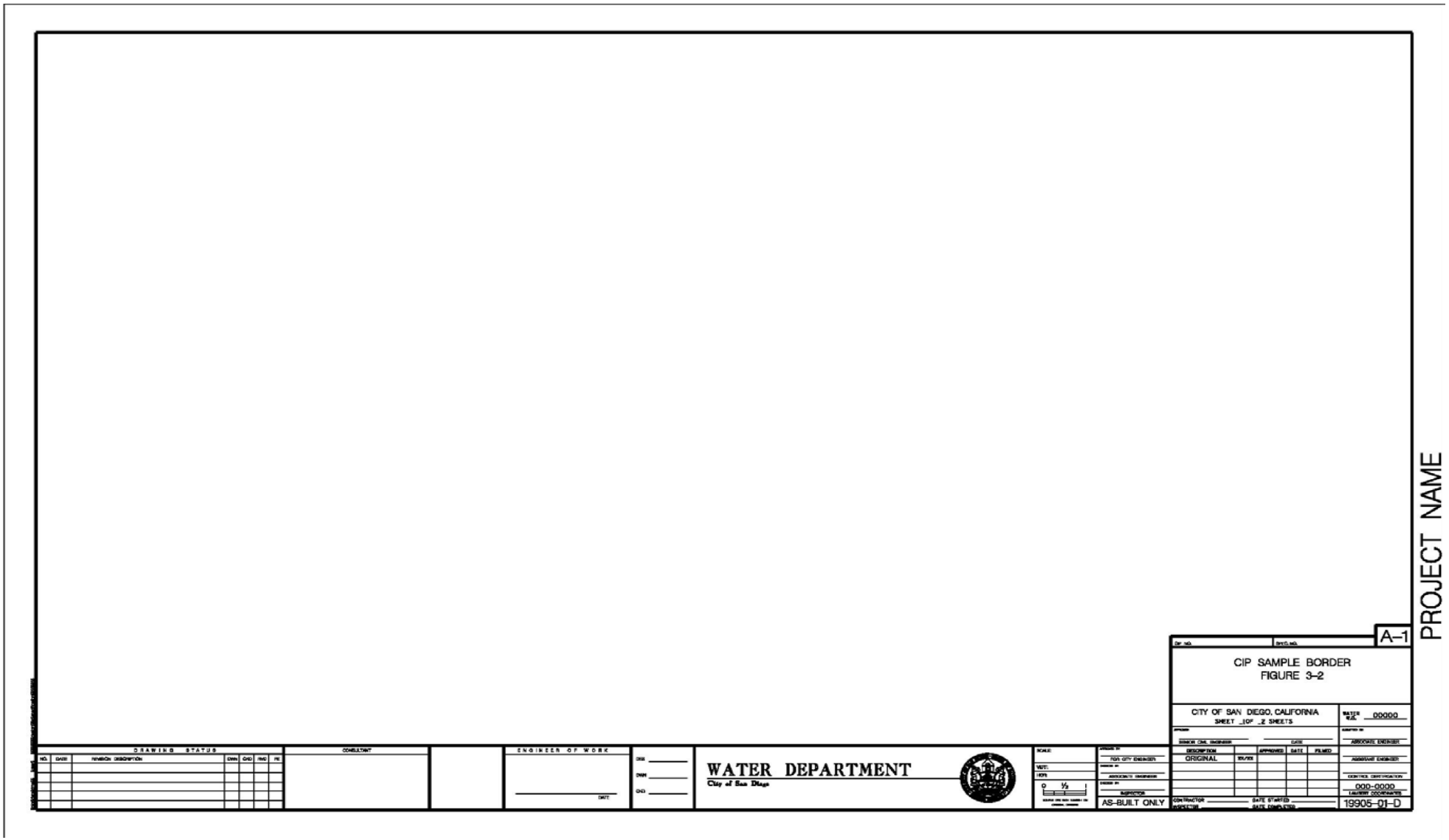
AS-BUILT ONLY

DESCRIPTION		APPROVED	DATE	FILMED
ORIGINAL	XX/XX			

CONTRACTOR
INSPECTOR
DATE STARTED
DATE COMPLETED

000-0000
LAMBERT COORDINATES
19905-01-D

Figure 3-2
CIP Sample Border



(1) DESIGN CONSULTANT INTERNAL SHEET NUMBER
(2) CITY APPROVALS
(3) CITY DRAWING NUMBER (FIRST FIVE DIGITS ASSIGNED BY MAPS & RECORDS)
(4) WORK ORDER NUMBER
(5) SPECIFICATION NUMBER (ASSIGNED BY CIP PROJECT MANAGER)
(6) PROJECT NAME / DRAWING DESCRIPTION
(7) NUMBER OF CURRENT SHEET AND TOTAL NUMNER OF SHEETS
(8) CIP NUMBER (ASSIGNED BY CIP PROJECT MANAGER)
(9) CONTRACTOR / INSPECTOR INFORMATION
(10) CIP APPROVALS
(11) SCALE WARNINGS
(12) PROGRAM IDENTIFICATION
(13) ENGINEERS STAMP
(14) DESIGN CONSULTANT LOGO
(15) DRAWING STATUS / REVISION
(16) CADD DESIGN FILE NAME / DATE / TIME / CADD OPERATOR

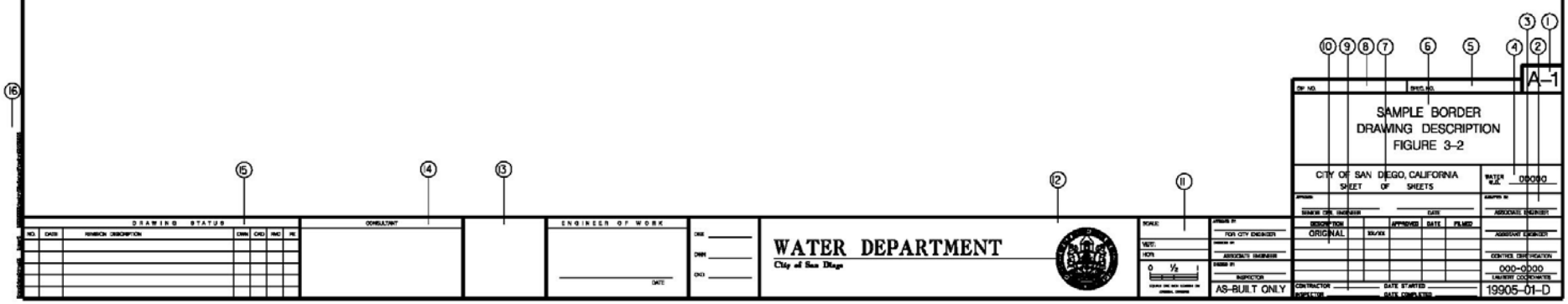


Figure 3-3
Leroy Lettering Set and Template Sizes

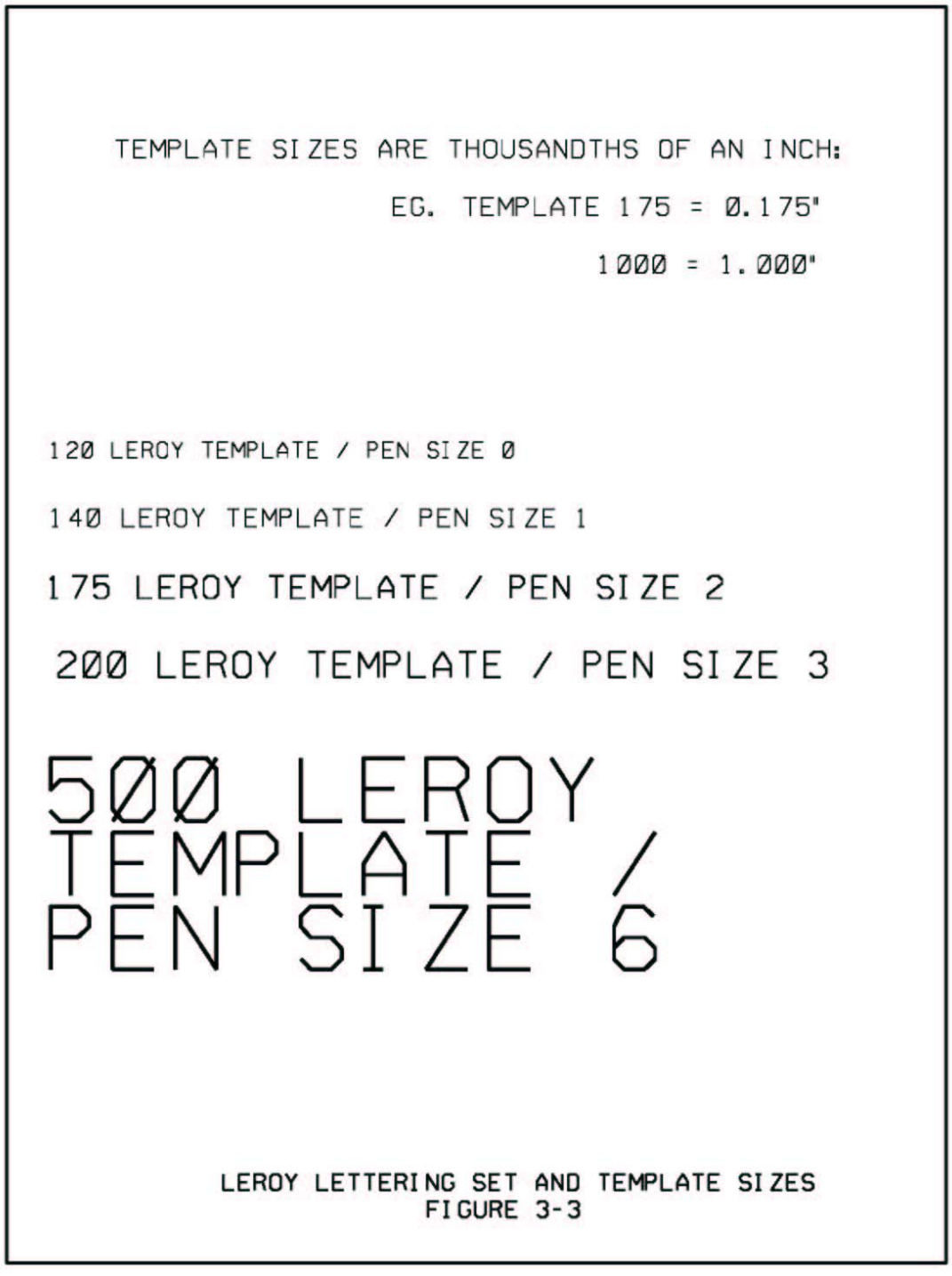


Figure 3-4
Reading Direction

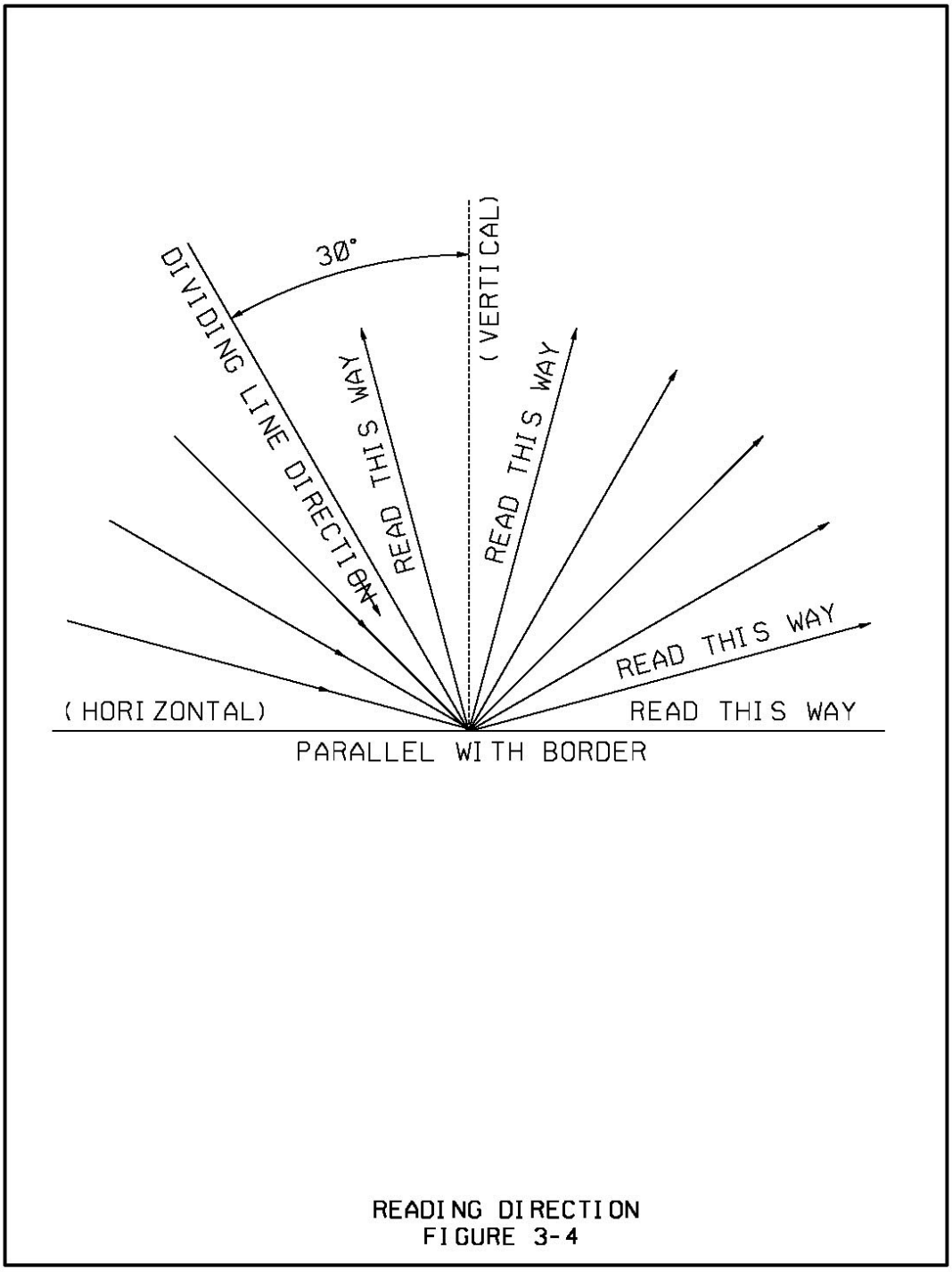


Figure 3-5
Line Patterns and Widths

NAME	PATTERN	WIDTH	PEN SIZE
SCHEMATIC MAIN PROCESS		EXTRA HEAVY	3
SCHEMATIC SECONDARY PROCESS		HEAVY	2
CUTLINE-PROPOSED FACILITIES		HEAVY	2
CUTTING PLANE LINE		HEAVY	2
DOUBLE LINE PIPING FLANGE		HEAVY	2
MATCH LINE		MEDIUM	1
SINGLE LINE FLANGE		MEDIUM	1
EQUIPMENT	VARIES	MEDIUM	1
OUTLINE EXISTING FACILITIES		FINE	ØØ
OUTLINE FUTURE FACILITIES		FINE	ØØ
HIDDEN LINE PROPOSED FACILITIES		FINE	ØØ
HIDDEN LINE EXISTING FACILITIES		EXTRA FINE	ØØØ
DIMENSION LINES		EXTRA FINE	ØØØ
LEADER LINE (CALLOUT LINE)		EXTRA FINE	ØØØ
LONG BREAKING LINE		EXTRA FINE	ØØØ
CENTERLINE, COLUMN LINE, STRUCTURE OUTLINE		EXTRA FINE	ØØØ
PHANTOM LINE		EXTRA FINE	ØØØ

LINE PATTERNS AND WIDTHS
FIGURE 3-5

Figure 3-6
Column Lines and Balloons

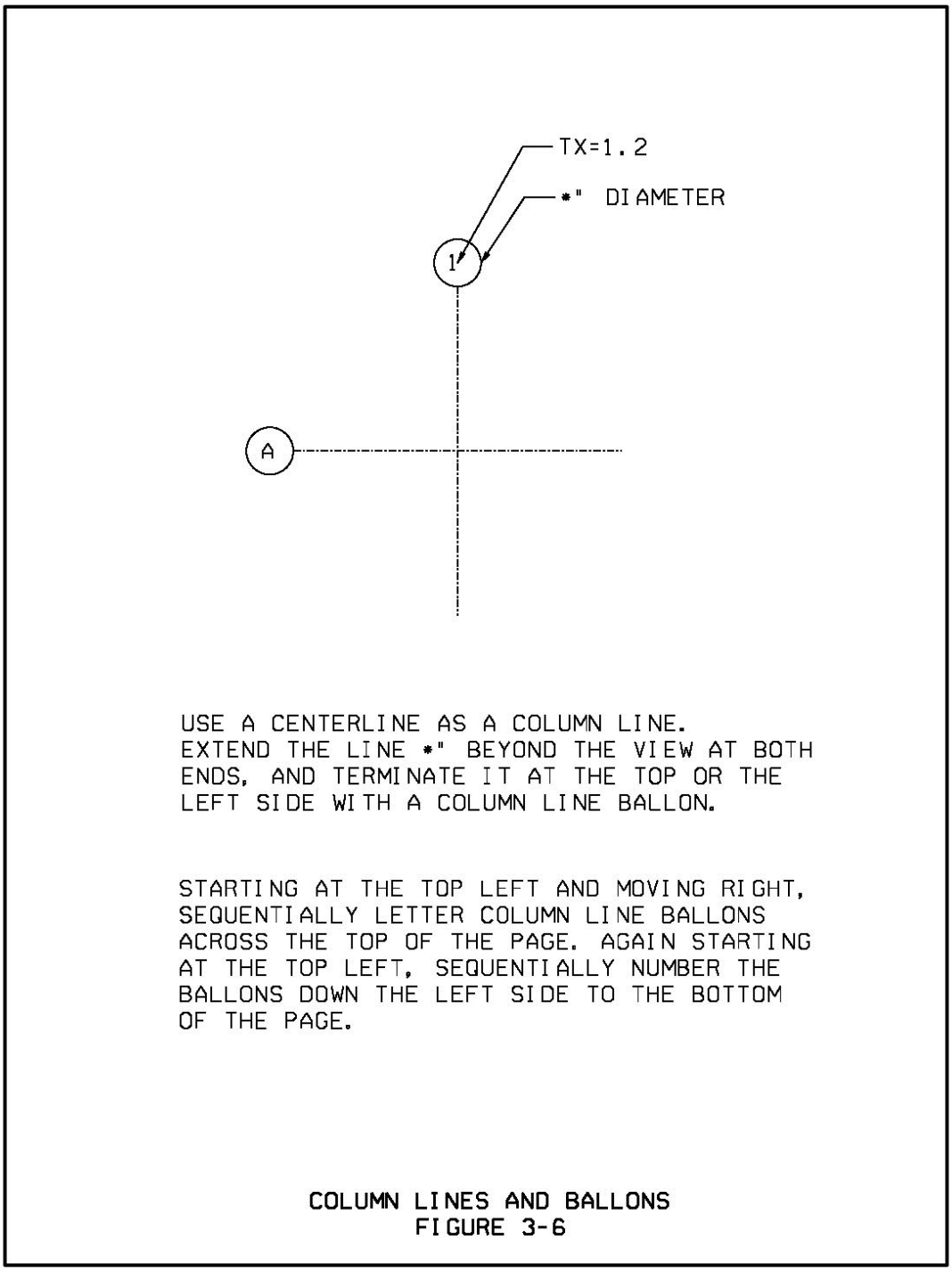


Figure 3-7
Dimensioning

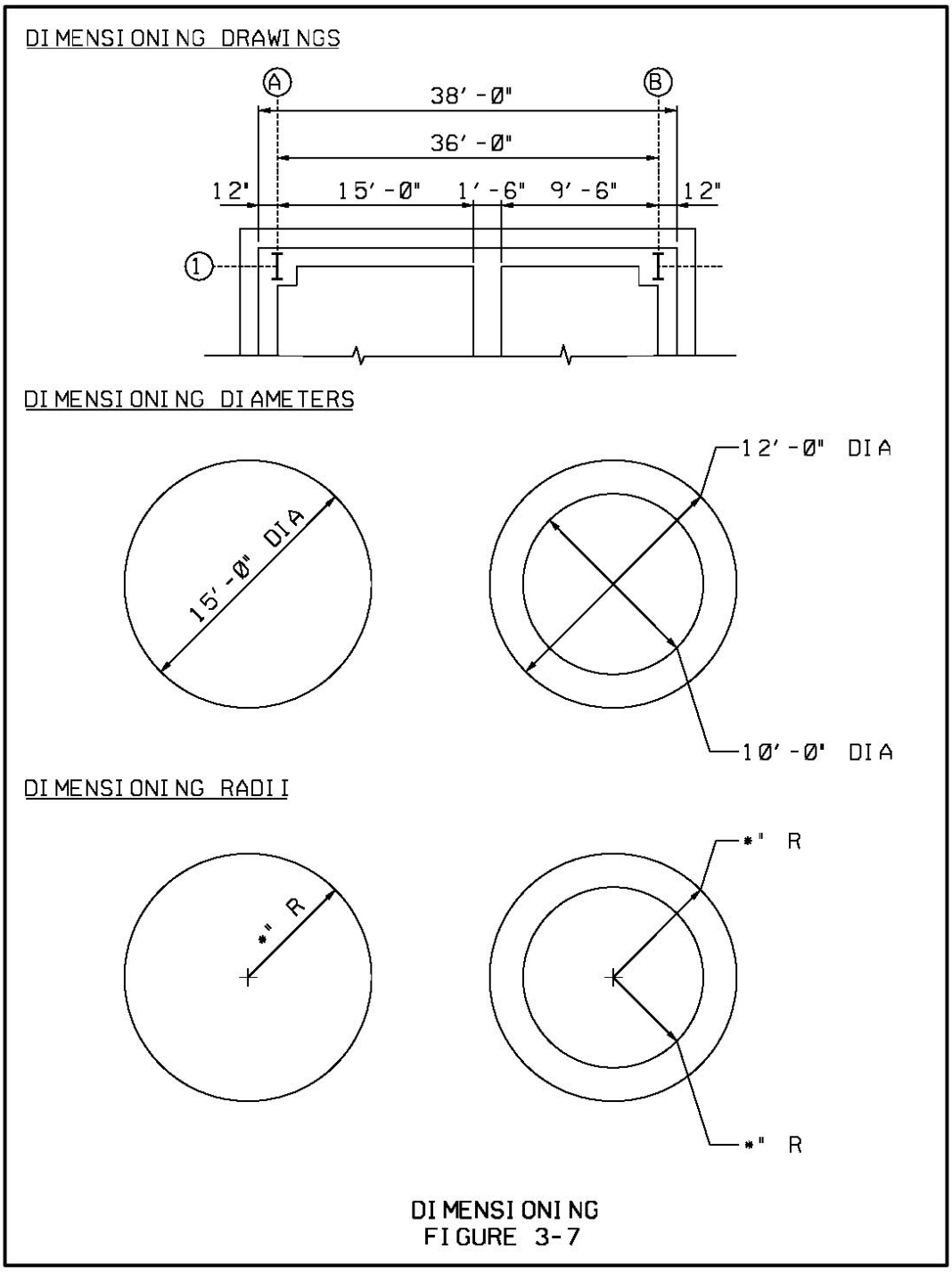


Figure 3-8
Section Callout

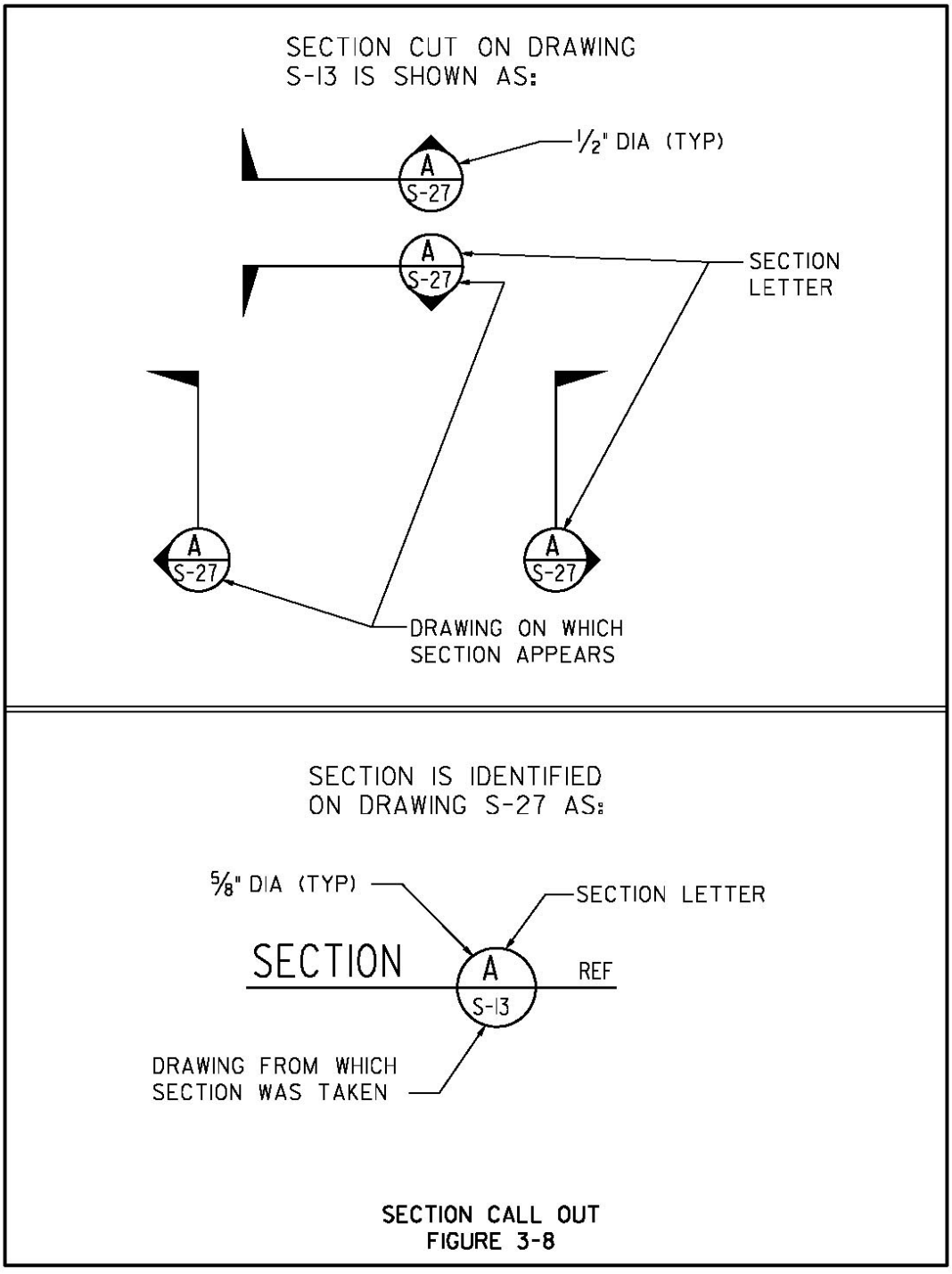


Figure 3-9
Detail Callout

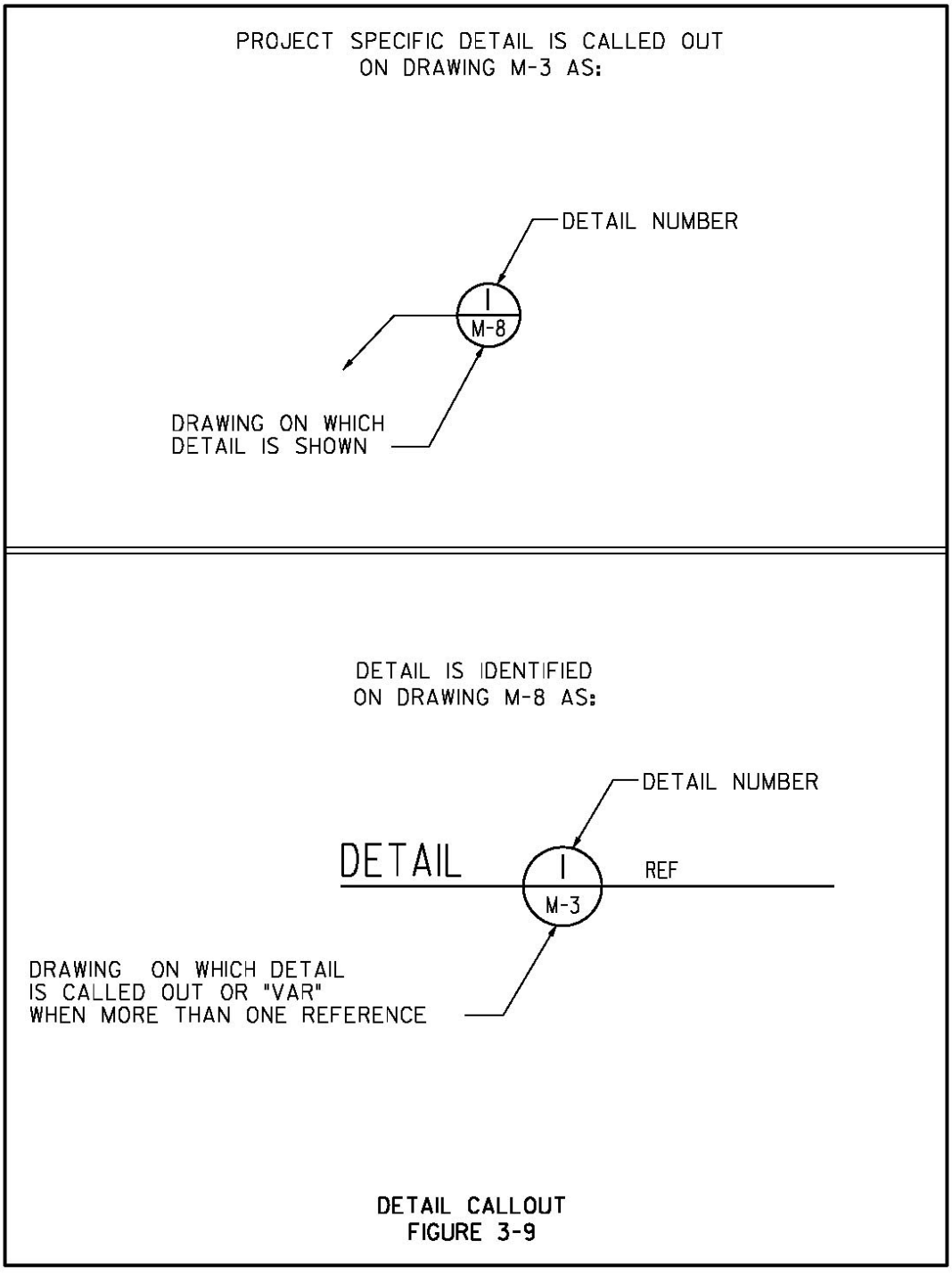


Figure 3-10
Standard Detail Callout

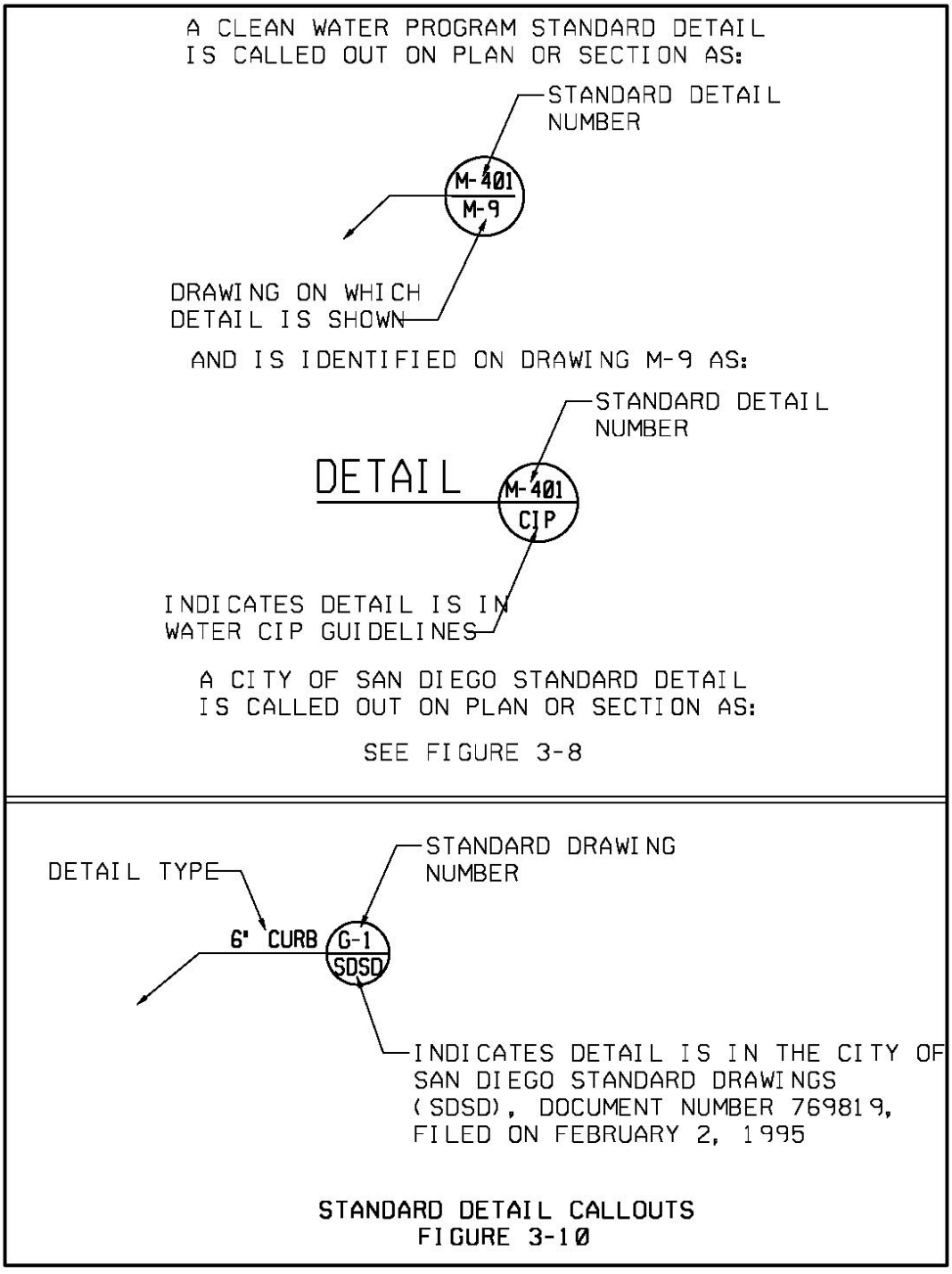


Figure 3-11
Equipment and Piping Callouts

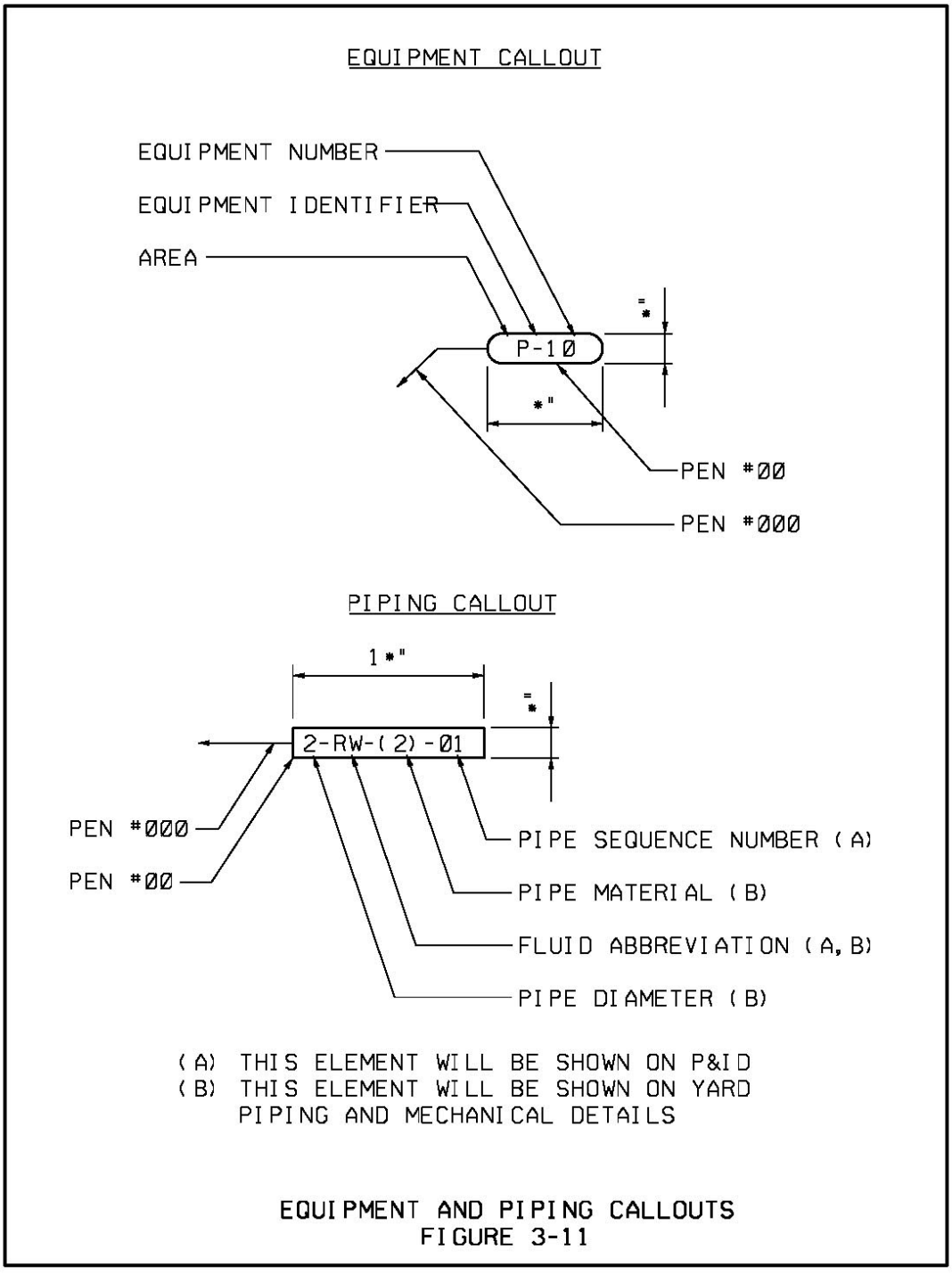


Figure 3-12
Location of General Notes

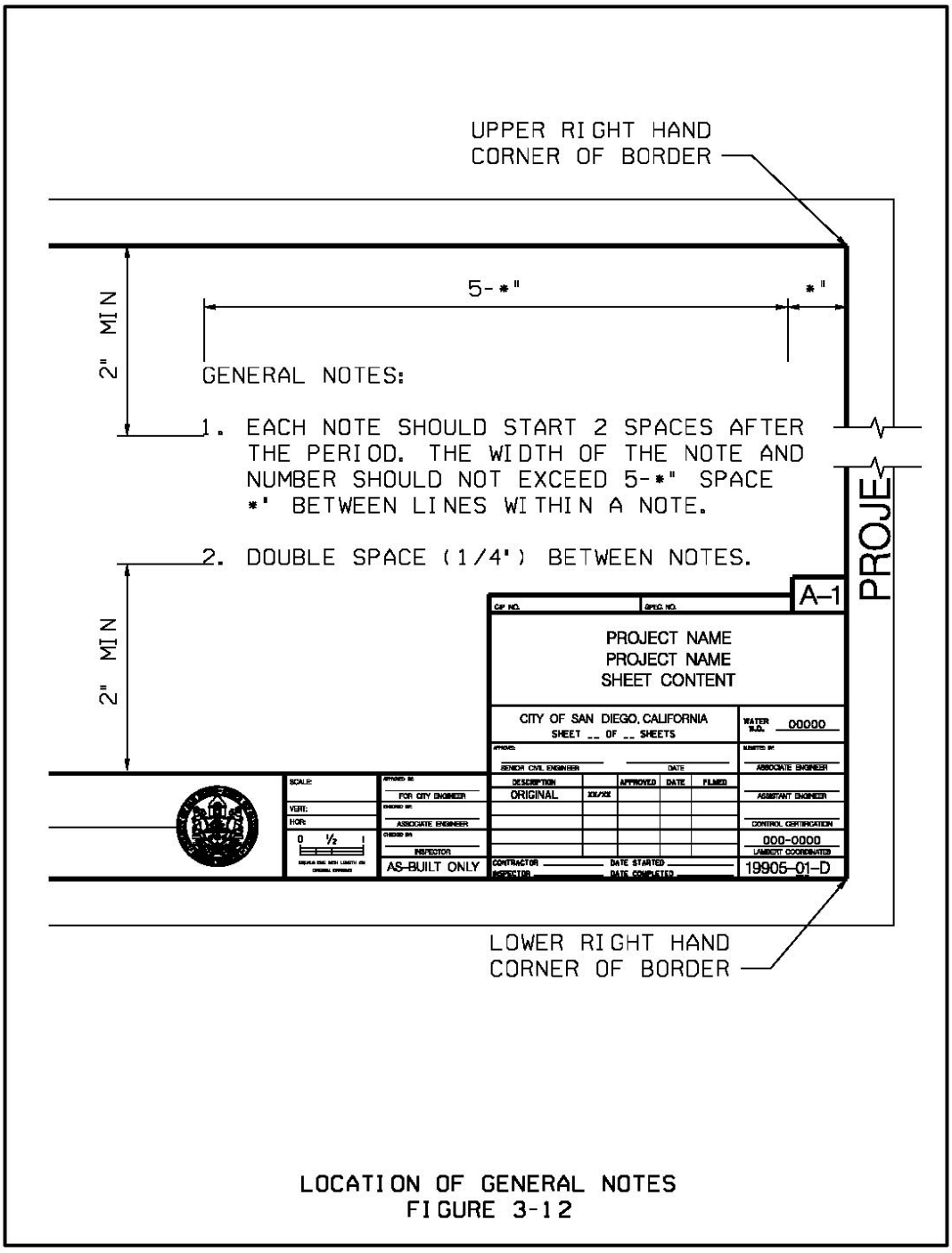


Figure 3-13
View Notes and Leaders

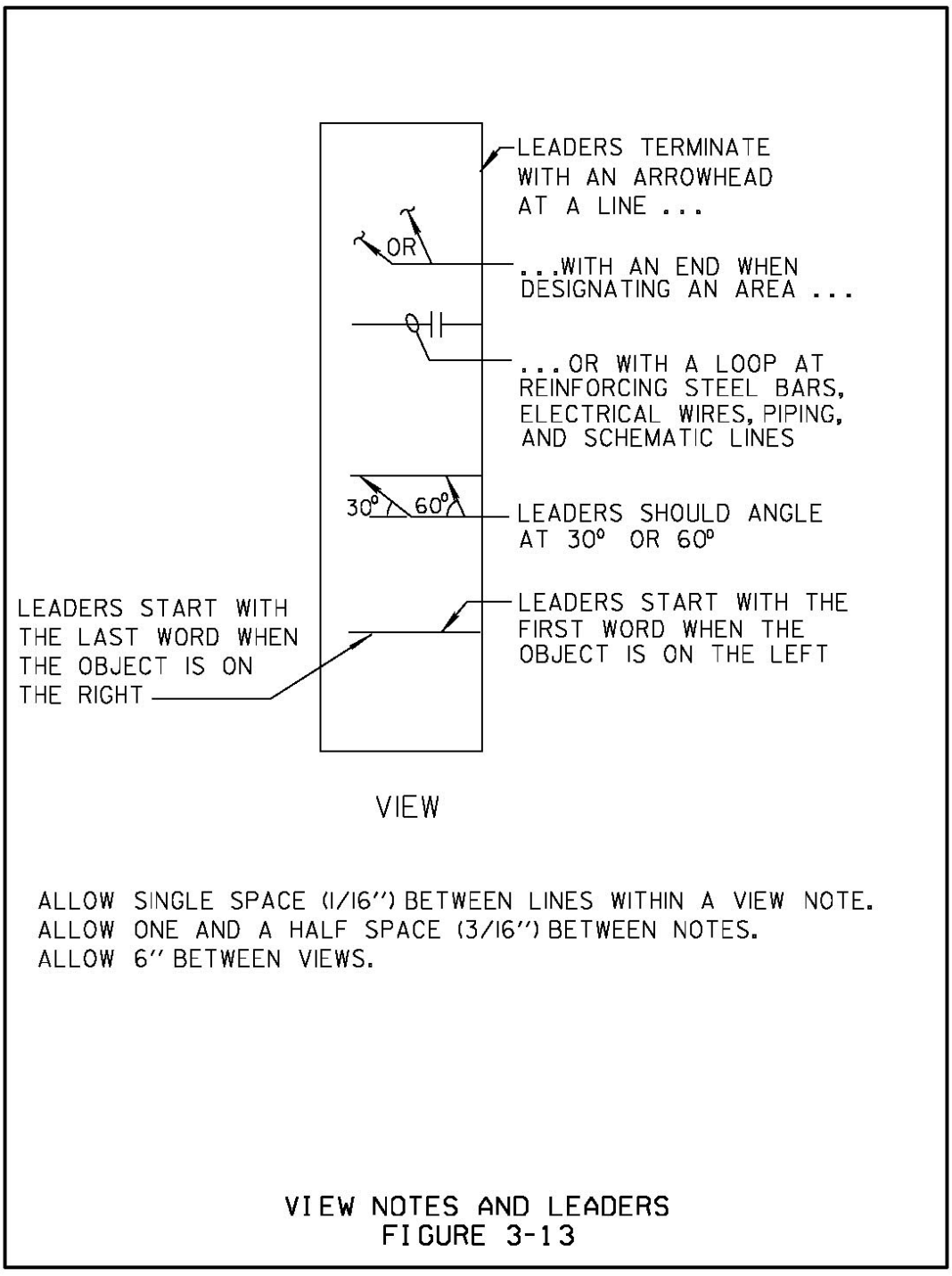


Figure 3-14
North Arrow Direction

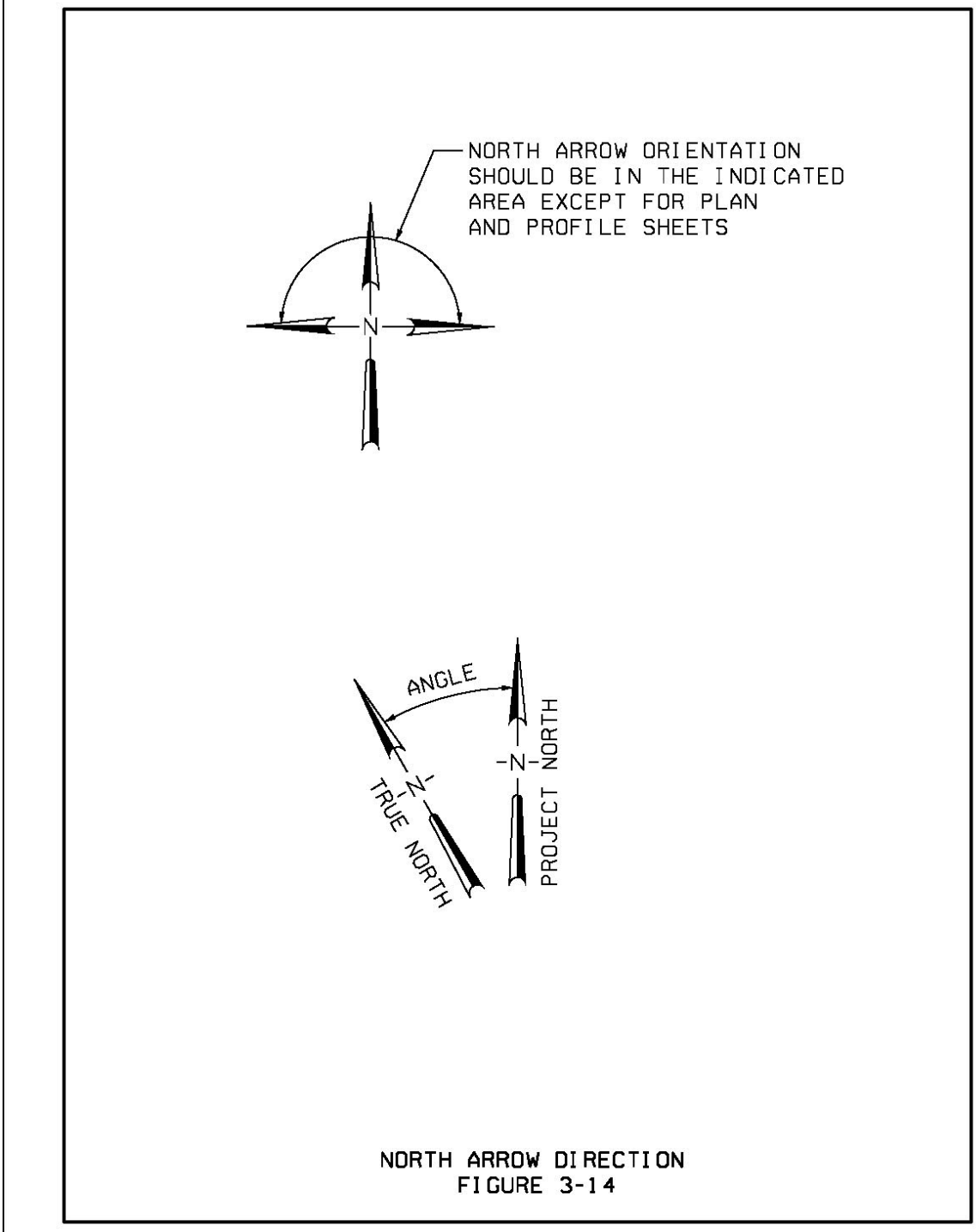


Figure 3-15
Sample Cover Sheet

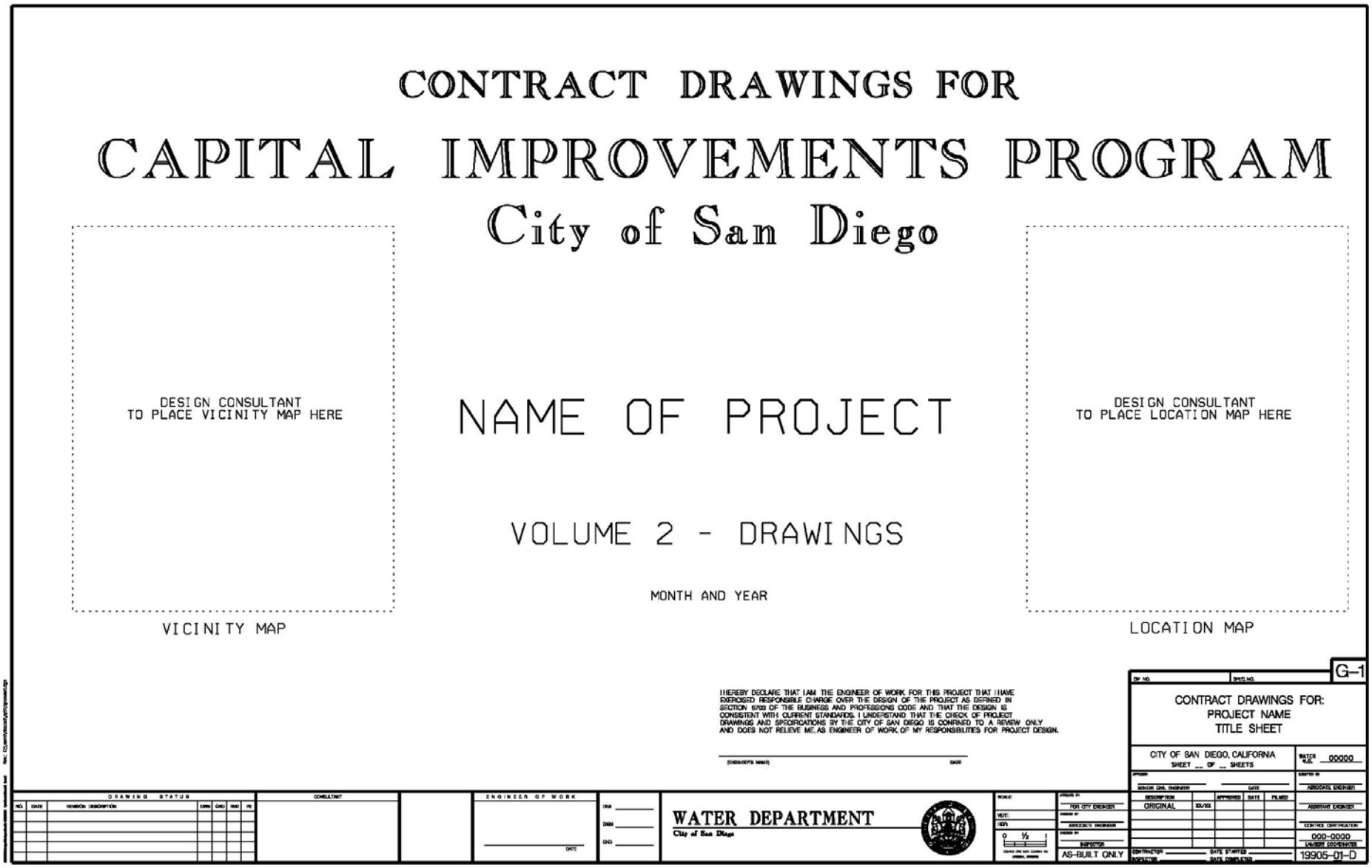


Figure 3-16
Sample Plan and Profile Sheet

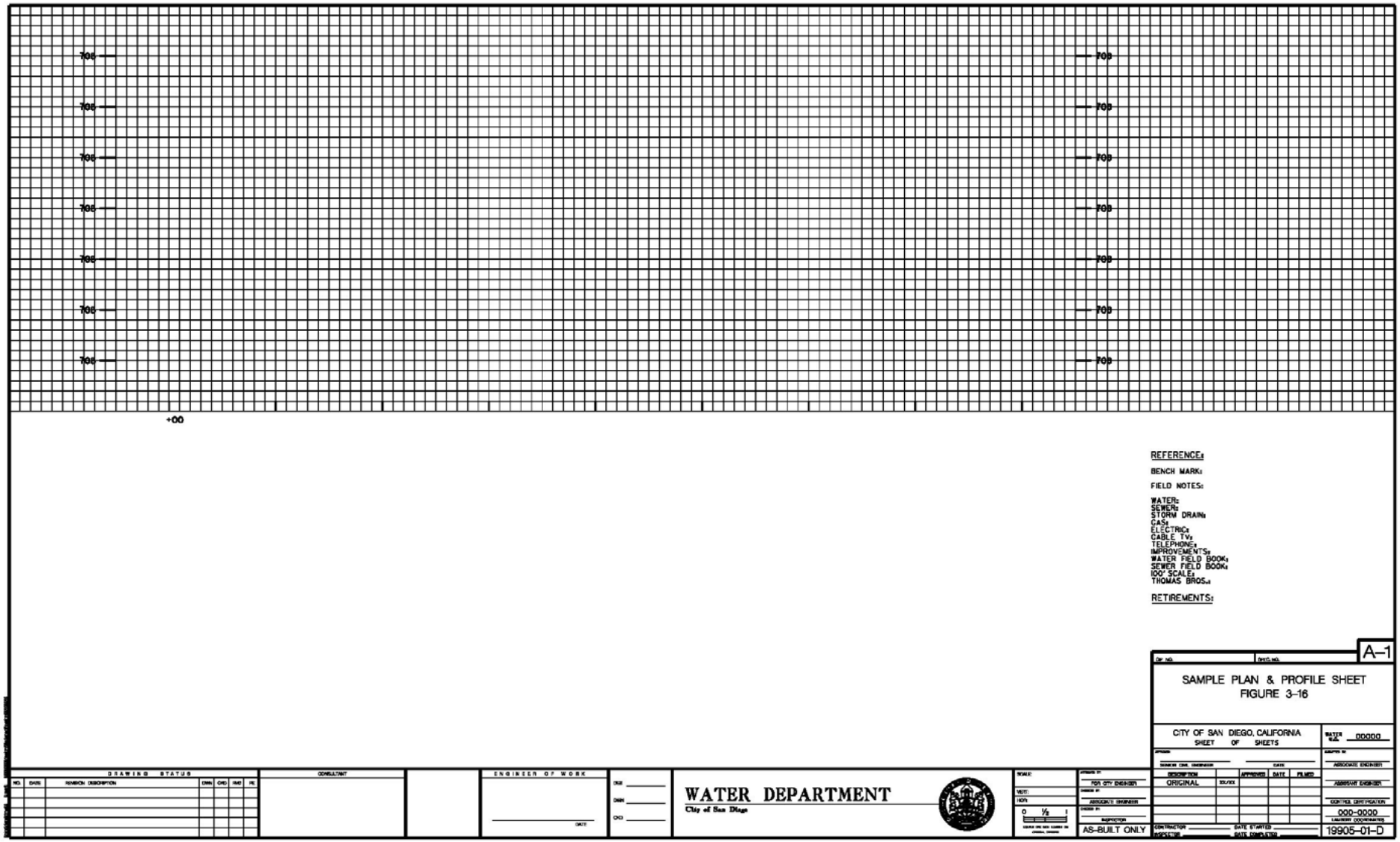
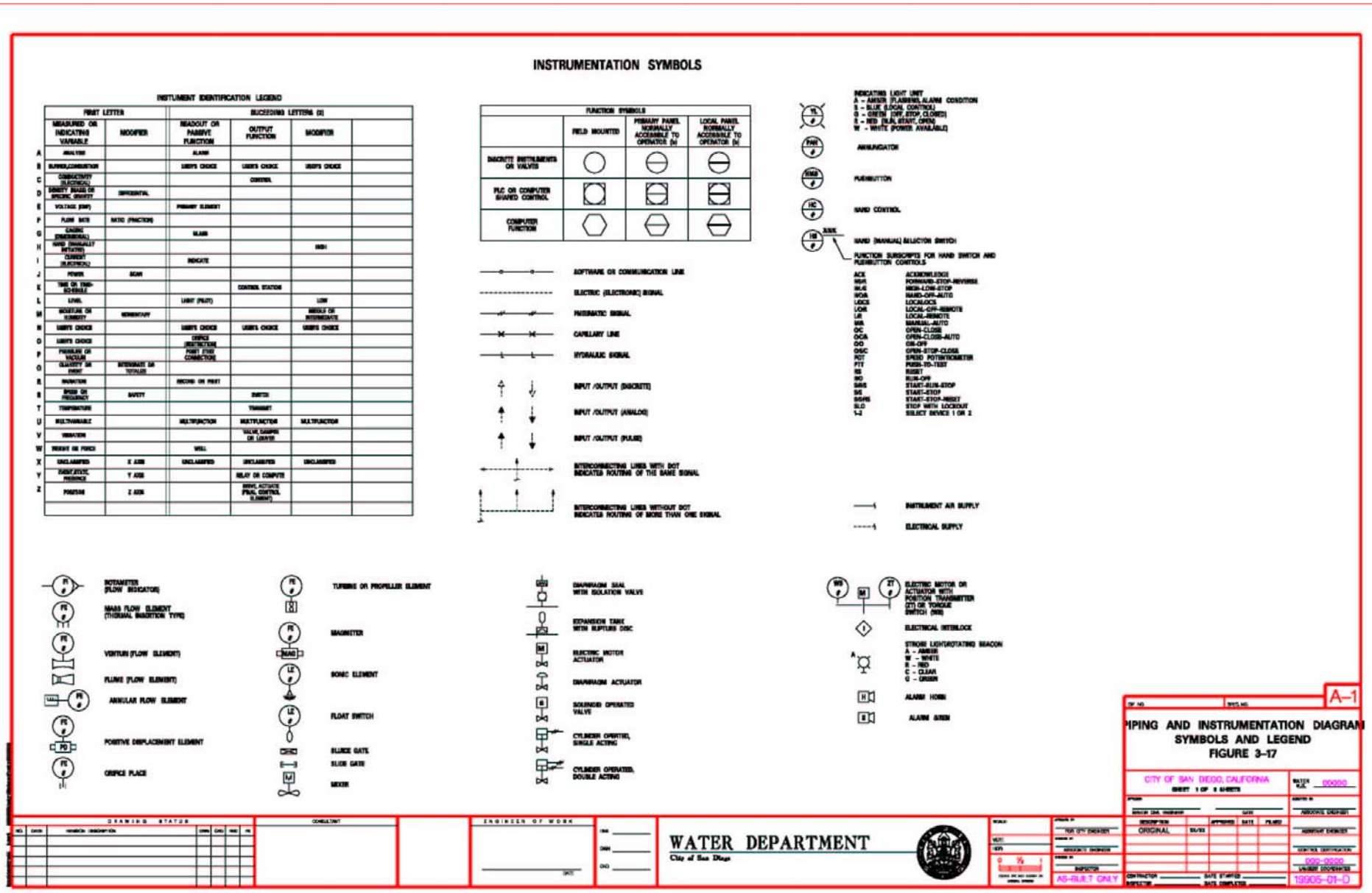
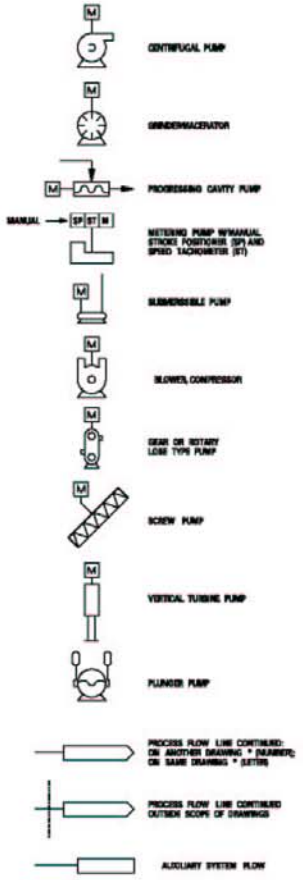
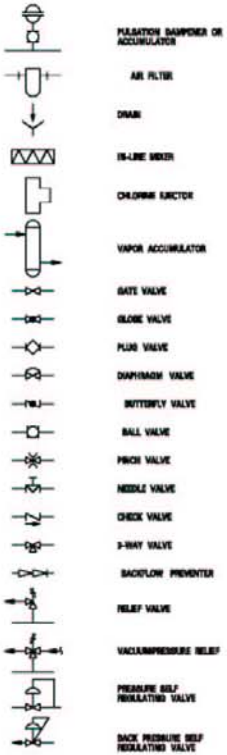


Figure 3-17
Sample P&ID Symbols and Legend Sheet



EQUIPMENT SYMBOLS





MAIN PROCESS LINE

AUXILIARY SYSTEMS

HEAT TRACED AND INSULATED

LINE DESIGNATOR

P08SW3-6"-AAAA3-ET-SR

- STRESS RELIEF
- INSULATION CODE (SEE TABLE)
- PIPING LINE CLASS
- PIPE SIZE
- SEQUENCE NUMBER
- UNIT NUMBER
- COMMODITY

INSULATION TABLE

TYPE OF INSULATION	HOT	COLD
PROCESS CONTROL	I	IC
ENTROPY CONSERVATION	E	EC
PERSONNEL PROTECTION	P	PC
ELECTRIC TRACED	ET	EA
STEAM TRACED	ST	SA
GLYCOL TRACED	GT	GA
NOISE ABATEMENT	A	AC
FIRE PROTECTION	F	FP
TRACED FOR FREEZE PROTECTION	ET/ST/GT	EA

EQUIPMENT TRIM DESIGNATOR

VT-48C205-AAAA3-I

- TRIM INSULATION (APPLICABLE PER TRIM ONLY EQUIPMENT INSULATION DEFINED UNDER EQUIPMENT LABEL)
- TRIM LINE CLASS
- EQUIPMENT NUMBER
- UNIT NUMBER
- EQUIPMENT TRIM CODE

TIE-IN NUMBER

TIE-IN CONNECTION (TO EXISTING)

SHUTDOWN OR UNIT NUMBER

SP / S — SPECIALTY ITEM

* — FURNISHED WITH EQUIPMENT

SLIP BLIND

SPECTACLE BLIND

HAMER BLIND

MISCELLANEOUS ABBREVIATIONS

AS	AIR SUPPLY
AVT	AUTOMATIC VENT TRAP
BD	BLOWDOWN
BF	BLIND FLANGE
BL	BATTERY LIMIT
CAD	CLOSED AREA DRAIN
CBD	CONTINUOUS BLOWDOWN
CD	CLOSED DRAIN
CHLO	CHLOR OPERATED
CSC	CAR SEAL CLOSED
CSO	CAR SEAL OPEN
CWR	COOLING WATER RETURN
CWS	COOLING WATER SUPPLY
DC	DRAIN CONNECTION
ESD	EMERGENCY BLOWDOWN VALVE
ESD	EMERGENCY SHUTDOWN
FC	FAIL CLOSED
FO	FAIL OPEN
HC	HOSE CONNECTION
HOA	MANUAL STATION FOR SELECTION OF HAND (ON) – OFF – AUTOMATIC MODE OF OPERATION
IBD	INTERMITTENT BLOWDOWN
LC	LOCK CLOSED
LO	LOCK OPEN
ML	MANUAL LOADING
NC	NORMALLY CLOSED
NO	NORMALLY OPER
OD	OPEN DRAIN
P	PERSONNEL PROTECTION
PO	PUMP OUT
QO	QUICK OPENING
SC	SAMPLE CONNECTION OR SPRING CLOSED
SO	STEAM OUT OR SPRING OPENS
TSO	TIGHT SHUT OFF
VB	VACUUM BREAKER
WC	WATER COLUMN

A–1

PIPING AND INSTRUMENTATION DIAGRAM SYMBOLS AND LEGEND FIGURE 3-17

CITY OF SAN DIEGO, CALIFORNIA

DRAWING STATUS

NO.	DATE	REVISION / DESCRIPTION	DRWN	CHKD	ENGR	PE

CONSULTANT

ENGINEER OF WORK

DATE

DES

DRWN

CHKD

WATER DEPARTMENT
City of San Diego

DESCRIPTION	BY	APPROVED	DATE	PE NO.
ORIGINAL				

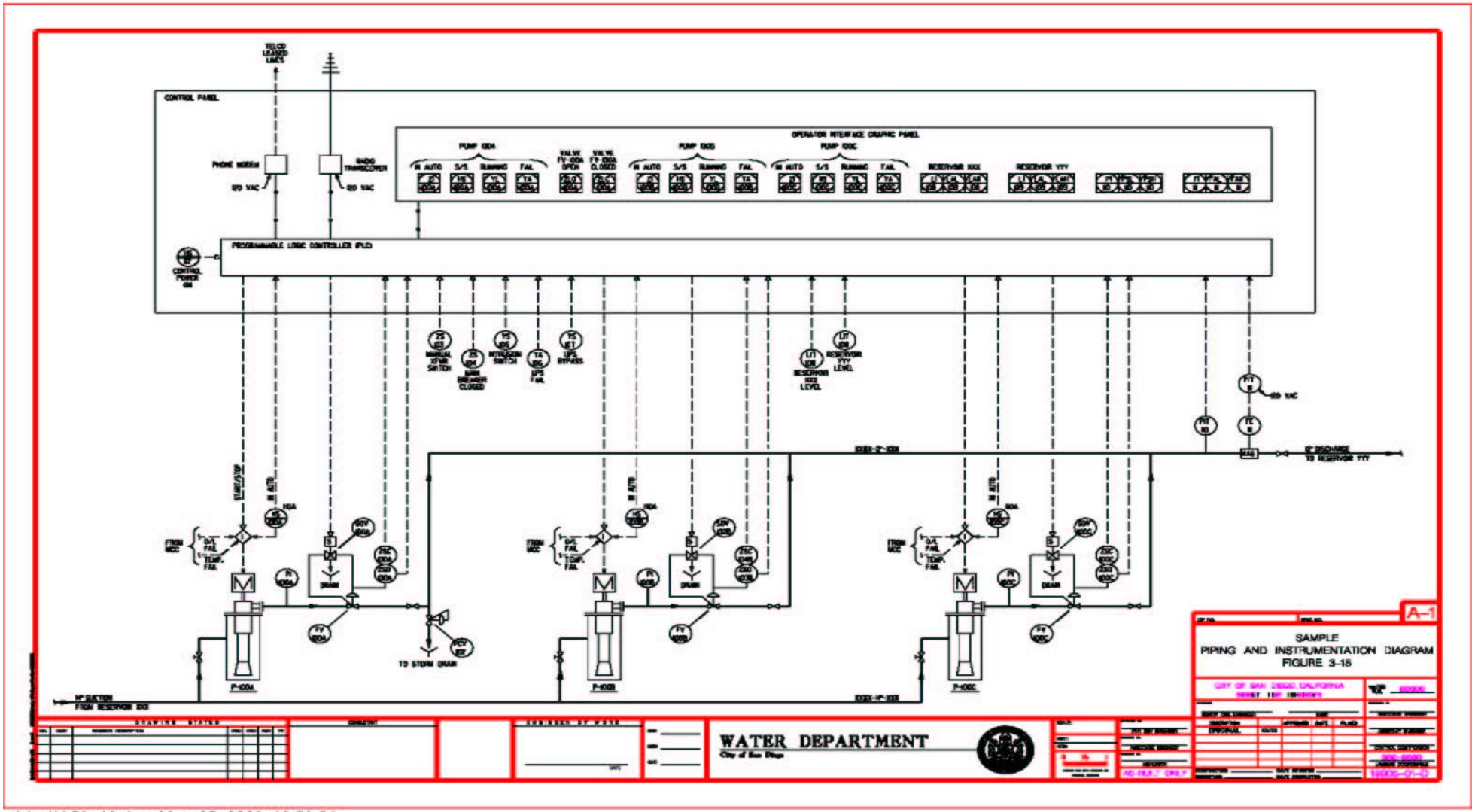
AS-BUILT ONLY

WATER W.O. 00000

002-0020

12905-01-D

Figure 3-18
Sample P&ID



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